Alberta Environment: Report on 2008 Greenhouse Gas Emissions

April 2010

Government of Alberta

Alberta

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Executive Summary

In 2002, Alberta signaled its commitment to manage climate change and greenhouse gas emissions in the province by passing the *Climate Change and Emissions Management Act.* One of the first actions taken under the new legislation was to develop a mandatory reporting program for large industrial emitters in Alberta. Beginning in 2004, large industrial emitters in the province were required to submit an annual report on their previous year's greenhouse gas emissions. The province has now collected data for five consecutive reporting periods, including the 2008 emissions year.

Alberta's regulatory framework has since continued to evolve. In 2007, building from the information collected through the reporting program, Alberta passed the *Specified Gas Emitters Regulation*, reinforcing its commitment to regulate greenhouse gas emissions from large industrial emitters. This regulation requires all facilities in Alberta emitting over 100,000 tonnes of carbon dioxide equivalent per year to reduce their emissions intensity by 12 per cent below a baseline based on 2003-2005 emissions. In the future, Alberta will look to consolidate both regulations to streamline and reduce the overall reporting burden for Alberta's large emitters.

In 2008, the province released its *2008 Climate Change Strategy*, establishing practical, achievable goals for further reductions in greenhouse gas emissions. The strategy commits to taking action on three themes: conserving and using energy efficiently; implementing carbon capture and storage; and greening energy production. By 2050, Alberta will see a reduction of 200 megatonnes (one megatonne = one million tonnes) over business-as-usual projections.

Alberta recognizes that continuous changes and targeted actions will be required as we learn more, achieve positive results, and identify new opportunities and solutions. The strategy also reflects Alberta's unique position as an energy supplier to the world and the reality that, for the foreseeable future, the world will continue to rely on Alberta's secure supply of oil and gas. By beginning now to reduce the rate of emissions, Alberta will ensure that significant and lasting reductions will occur.

Results of the 2008 Reporting Program

In 2008, 109 facilities in Alberta reported greenhouse gas emissions. Total reported greenhouse gas emissions for the 2008 calendar year, from sources of carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride, equalled 110.9 megatonnes (Mt) in carbon dioxide equivalent. Since the *National Mandatory Greenhouse Gas Reporting Program* began, reported Alberta greenhouse gas emissions have increased by 2.2 per cent or 2.4 Mt, from 108.5 Mt in 2004. The number of facilities reporting has increased by 11 from 98 in 2004.

From 2007, the number of facilities that reported emissions increased by three, with a decrease in total reported emissions by 3.0 per cent from the 115.0 Mt. Carbon dioxide accounted for 96.4 per cent of the total emissions with the remainder coming from methane (2.3 per cent), nitrous oxide (1.2 per cent), hydrofluorocarbons (<0.1 per cent) and sulphur hexaflorine (<0.1 per cent). No Alberta facilities reported emissions of perfluorocarbons.

There were 102 Alberta facilities that reported in both 2007 and 2008. Total reported emissions from these facilities decreased by 4.0 per cent from 114.0 Mt to 109.5 Mt). Of these 102 facilities that reported in both 2007 and 2008, 45 facilities reported higher emissions in 2008 and 57 reported lower emissions.

The utilities sector was the largest emitting source in Alberta, emitting 44.1 per cent of the total reported emissions, followed by oil sands operations at 31.4 per cent (consisting of the oil sands mining and upgrading sector at 21.5 per cent and the oil sands in situ extraction sector at 9.9 per cent), the chemical manufacturing sector (9.3 per cent), and the conventional oil and gas extraction (6.2 per cent) sector. The remaining 9.0 per cent of emissions came from the petroleum refining, pipeline transportation, mineral manufacturing, coal mining, forestry products, and waste management sectors.

In Alberta, 85.1 per cent of reported emissions were from stationary fuel combustion, with the remainder generated by industrial process (8.4 per cent), venting and flaring (2.5 per cent), other fugitive (2.1 per cent), on-site transportation (1.8 per cent) and waste and wastewater (<1 per cent) sources.

Across Canada, a total of 262.6 Mt of greenhouse gas emissions were reported in 2008 from large industrial facilities. Alberta was the largest provincial contributer at 42 per cent, due to a large energy industry in Alberta and a large portion of Alberta's electricity coming from coal fired power plants. Other major provincial emitters were Ontario (26 per cent), Saskatchewan (8 per cent), Quebec (8 per cent) and British Columbia (5 per cent).

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Abbreviations

CH_4:	methane
CO_2:	carbon dioxide
CO_2e:	carbon dioxide equivalent
HFC:	hydrofluorocarbon
kt:	kilotonne
Mt:	megatonne
N_2O:	nitrous oxide
PFC:	perfluorocarbon
SF_6:	sulphur hexafluoride

1.0 Alberta taking action on climate change

1.1 Goals and policies

The Government of Alberta is committed to reducing provincial greenhouse gas emissions. Alberta's plans are outlined in its *2008 Climate Change Strategy*. The strategy builds on what has already been done: implementing the first legislation of its kind in Canada to reduce greenhouse gas emissions, laying out the long-term roadmap to Alberta's 2020 and 2050 reduction objectives.

The strategy reflects Alberta's unique position as an energy supplier to the world and the reality that, for the foreseeable future, the world will continue to rely on Alberta's secure supply of oil and gas. The strategy also establishes practical, achievable goals for real reductions in greenhouse gas emissions. Instead of setting arbitrary targets, Alberta's approach breaks the problem down into manageable "wedges" for action with corresponding reductions in emissions set for each wedge. Alberta recognizes that continuous changes and targeted actions will be required as we learn more, achieve positive results, and identify new opportunities and solutions.

Alberta's 2008 Climate Change Strategy commits to taking action on three themes: conserving and using energy efficiently; implementing carbon capture and storage; and greening energy production to transform the way we produce energy and to introduce cleaner, more sustainable approaches to energy production. The strategy also commits to quantitative results:

Year	Goal	Result
2010	Reduce projected emissions by 20 megatonnes	Meet intensity target established in 2002 plan
2020	Reduce projected emissions by 50 megatonnes	Stablilize greenhouse gas emissions and begin reductions
2050	Reduce projected emissions by 200 megatonnes	Emissions reduced by 50 per cent below business as usual levels and 14 per cent below 2005 levels

Alberta's provincial *Specified Gas Reporting Program* is an important aspect of managing climate change, providing real data to inform and enable effective policies for reducing industrial emissions of greenhouse gases. The three main components of the *Specified Gas Reporting Program* are: the *Specified Gas Reporting Standard*, the *Specified Gas Reporting Regulation*, and the *Climate Change and Emissions Management Act*.

The reporting program is intended to work in concert with the *Specified Gas Emitters Regulation*. Information gathered under the program is needed to assist both the province and industry in characterizing emission sources and identifying opportunities for emission reductions. The program provides an annual inventory of greenhouse gas emissions from large industrial facilities in the province and provides a platform for smaller facilities to voluntarily report their greenhouse gas emissions. It also assists the government in monitoring the results of greenhouse gas reduction strategies.

1.2 Specified gas reporting program

The Alberta *Specified Gas Reporting Program* requires that all large Alberta industrial facilities emitting more than 100,000 tonnes of greenhouse gases in carbon dioxide equivalent (CO_2e) units per year—based on the sum of direct emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perflurorocarbons (PFCs) and sulphur hexafluoride (SF_6)—report their greenhouse gas emissions to Alberta Environment. Facilities that do not exceed the 100 kt regulatory threshold may voluntarily report their emissions under the *Specified Gas Reporting Program*.

Facilities are required to submit their reports through an Electronic Data Reporting system, which is administered by Statistics Canada. In 2005 (for 2004 emissions collection), Alberta harmonized its *Specified Gas Reporting Program* with the *National Mandatory Greenhouse Gas Reporting Program*. Alberta Environment and Environment Canada have jointly collected 2004, 2005, 2006, 2007 and 2008 greenhouse gas data from Alberta's largest industrial emitters. Alberta facilities report once through the Electronic Data Reporting system and results are forwarded to Environment Canada and Alberta Environment to satisfy both provincial and federal reporting requirements. Alberta facilities are required to submit separate statements of certification and requests for confidentiality directly to both Environment Canada and Alberta Environment via mail or courier.

1.3 Specified gas emitters regulation

The *Specified Gas Emitters Regulation* came into force on July 1, 2007 and is an important step in delivering on the Alberta's *2008 Climate Change Strategy*. The new requirement for large industry to reduce their emissions intensity by 12 per cent is mandated under a regulation in the *Climate Change and Emissions Management Act*.

The *Specified Gas Emitters Regulation* requires all facilities in Alberta emitting over 100,000 tonnes of carbon dioxide equivalent (CO_2e) per year to reduce their emissions intensity by 12 per cent below a baseline based on 2003-2005 emissions. New facilities, or those facilities that began operation on or after January 1, 2000 and that have completed less than 8 years of commercial operation, are required to reduce their emissions intensity by 2 per cent per year starting in their fourth year of commercial operations. The reduction obligation for new facilities ramps up by 2 per cent per year until the ninth year of commercial operations when a 12 per cent target is reached. Facilities have several options to meet their emissions intensity reduction targets:

- Improve facility operations and efficiency;
- Pay $15 per tonne of CO_2e into the Climate Change and Emissions Management Fund, which creates a pool of resources to enable additional projects or technology aimed at reducing greenhouse gas emissions in the province,
- Purchase emission offset credits generated from projects not subject to the *Specified Gas Emitters Regulation*. These credits must be from Alberta-based projects that occurred after January 1, 2002; or

- Purchase emission performance credits from facilities that are subject to the *Specified Gas Emitters Regulation*. Some facilities may have reduced their emissions intensity beyond their target and may want to sell any extra reduction as a credit.

Facilities that exceed the 100,000 tonnes CO_2e reporting threshold must satisfy the requirements of both the *Specified Gas Emitters Regulation* and the *Specified Gas Reporting Regulation*. In time, Alberta will move to harmonize the two regulations to ensure easier reporting for facilities. The data collected under the *Specified Gas Emitters Regulation* will be used to update the emissions reported in the *Specified Gas Reporting Regulation* as this data must be verified by a third party and should therefore be of higher accuracy.

2.0 Specified gas reporting regulation annual report

2.1 Objective

This report is designed to communicate results from the 2008 reporting year of the *Specified Gas Reporting Program* and provide analysis of those results that are not provided elsewhere to Albertans. This report builds on previous annual reports available at:

www.environment.alberta.ca/2881.html

2.2 Report content

Greenhouse gas data for the 2008 calendar year, collected under the *Specified Gas Reporting Regulation*, is examined by greenhouse gas type, source category, facility, and the industrial sector. Emissions data from 2008 is also compared to emissions from past years of specified gas reporting.

2.3 About the data

This report uses data from the *Specified Gas Reporting Program* that is current as of September 14, 2009. Any changes to the Alberta or national greenhouse gas databases after this date are not reflected in this report. Rounding of emissions data has been done to present workable numbers in this report. As a result, the numbers presented in this report may differ slightly in sections of this report and may also differ slightly from the same data presented from other sources. This report uses greenhouse gas emissions data from two sources: the Alberta *Specified Gas Reporting Program* and the *National Mandatory Greenhouse Gas Reporting Program.*

Greenhouse gas emissions data from 2003, 2004, 2005, 2006 ,2007 and 2008, for Alberta facilities, was collected in accordance with the *Climate Change & Emissions Management Act*, *Specified Gas Reporting Regulation,* and the associated *Specified Gas Reporting Standard.* Emissions data for 2004 through 2008 was collected through the national one-window reporting system.

Reported greenhouse gas data for the rest of Canada was collected through the *National Mandatory Greenhouse Gas Reporting Program*, under the authority of the *Canadian Environmental Protection Act*, 1999 and is published on Environment Canada's website at:

www.ec.gc.ca/pdb/ghg/facility_e.cfm

2.4 Data changes

The 2008 greenhouse gas data presented in this report was collected using the March 2009 *Specified Gas Reporting Standard.* There have been updates to portions of the 2003, 2004, 2005 ,

2006 and 2007 datasets used to develop this report. Consequently, data presented in this report may differ from what was published in previous Alberta Environment greenhouse gas reports.

2.5 Changes to reporting

There has been a change to the way data is being reported by Alberta Environment for the 2008 greenhouse gas emissions data collected under the *Specified Gas Reporting Program* compared to other reporting years. The breakdown of the sectors has been classified based on the reported North American Industrial Classification System (NAICS) code and grouped into the following industrial sectors:

Waste Management (Previously Landfills)
Pipeline Transportation (Previously Pipelines)
Mineral Manufacturing (Previously cement, lime and metal manufacturing)
Chemical Manufacturing (Previously fertilizer and petroleum chemicals)
Petroleum Refineries
Paper Manufacturing (Previously Forestry)
Utilities (Previously Electricity)
Coal Mining
Oil Sands Mining and Upgrading
Oil Sands In Situ Extraction (Previously Heavy Oil)
Conventional Oil and Gas Extraction (Previously Gas Processing)

2.6 Data quality and program enforcement

The 2008 greenhouse gas emissions data that was collected under the *Specified Gas Reporting Program* has undergone several checks by Alberta Environment, Environment Canada and Statistics Canada to ensure facilities exceeding the threshold complied with the reporting requirement and to attempt to identify major errors in submitted data. As these are reported values, it is encumbent upon reporting facilities to submit the most accurate greenhouse gas emissions data possible.

Facilities are required to retain all records, data and information used in the preparation of a specified gas report for at least three years after the report is submitted. Facilities must also submit a statement of certification signed by a certifying official at the facility (a person with authority to bind the reporting company) stating that they reviewed the specified gas report, and exercised due diligence to ensure that the submitted information is true and complete and that the amounts and values being submitted are accurate, based on reasonable estimates using available data. These regulatory requirements ensure that facilities are submitting reasonably correct emissions information and that there is a paper trail in case Alberta Environment needs to verify the submitted emissions data.

Reporting to the *Specified Gas Reporting Program* is a mandatory regulatory requirement for facilities exceeding 100 kt CO_2e in annual greenhouse gas emissions. The program provides an inventory of greenhouse gas emissions in the province for large emitters only, and does not

include smaller sources of emissions. Some unregulated facilities that do not exceed the threshold are voluntary participants in the program and are included in the inventory.

The *Specified Gas Reporting Program* has no requirement for facilities to use consistent methods across different reporting years, no requirement for similar facilities to use the same calculation methods and no requirement for a provincial or national auditing program.

Facilities that fail to meet the regulatory requirements of the *Specified Gas Reporting Program* could face enforcement action. Additional information on enforcement can be found by consulting the *Specified Gas Reporting Regulation*, *Administrative Penalty Regulation* and the *Climate Change and Emissions Management Act*.

2.7 Voluntary reporting

Under the *Specified Gas Reporting Program* facilities that do not exceed the 100 kt CO_2e reporting threshold may choose to voluntarily submit a specified gas report. There were 18 Alberta facilities that voluntarily reported 2008 emissions to Alberta Environment. The reported greenhouse gas emissions from these 18 facilities equals a combined total of 0.89 Mt, or 0.8 per cent of the total 2008 reported greenhouse gas emissions. The individual reported greenhouse gas emissions totals from these 18 voluntary facility reports ranges from 0.0 to 92.8 kt. Alberta Environment encourages industrial facilities that do not exceed the reporting threshold to voluntarily report their greenhouse gas emissions to the *Specified Gas Reporting Program*.

Alberta Environment would like to acknowledge the following companies for voluntarily submitting a specified gas report for one or more of their facilities under the greenhouse gas threshold.

Imperial Oil Resources
MEGlobal Canada Inc.
Keyera Energy
Blaze Energy Ltd.
City of Calgary
Bonavista Petroleum Ltd.
Candadian Gas and Electric
EnCana Oil & Gas Co. Ltd.
Mazeppa Processing Partnership
TransCanada Energy Ltd.
Dow Chemical Canada ULC
ATCO Power Canada Ltd.
Alberta Power (2000) Ltd.
General Scrap Partnership

3.0 Reported 2008 Alberta greenhouse gas emissions

3.1 Total reported greenhouse gas emissions by sector

In total, 109 facilities from 11 industrial sectors reported a total of 110.9 Mt CO_2e of greenhouse gas emissions in Alberta for the 2008 calendar year through the *Specified Gas Reporting Program*. Reported greenhouse gas emissions for each facility are presented in the Appendix. The total reported greenhouse gas emissions and the number of facilities reporting, for each industrial sector, are shown in Table 1.

Table 1: Total reported greenhouse gas emissions and report tally by industrial sector.

Sector	Reports Received	Total Sector Emissions (kt)	Per Cent of Total
Chemical Manufacturing	15	10,270	9.3%
Coal Mining	3	497	0.4%
Conventional Oil and Gas Extraction	29	6,845	6.2%
Mineral Manufacturing	6	2,403	2.2%
Oil Sands In Situ Extraction*	13	10,927	9.9%
Oil Sands Mining and Upgrading*	5	23,848	21.5%
Paper Manufacturing	4	478	0.4%
Petroleum Refineries	3	3,862	3.5%
Pipeline Transportation	4	2,797	2.5%
Utilities	26	48,903	44.1%
Waste Management	1	90	0.1%
Total	**109**	**110,921**	**100.0%**

*Oil sands operations include the oil sands in situ extraction and oil sands mining and upgrading sectors.

The utilities sector was the largest source of 2008 greenhouse gases in Alberta, emitting 44.1 per cent of total reported emissions, followed by oil sands operations, emitting 31.4 per cent of total reported emissions. The chemical manufacturing sectors was also a significant source of emissions, emitting 9.3 per cent of the total reported emissions. The conventional oil and gas extraction sector emited 6.2 per cent of total reported emissions, and petroleum refineries emitted 3.5 per cent of total reported emissions. Facilities in the pipeline transportation, mineral manufacturing, paper manufacturing, coal mining, and waste management sectors together accounted for the remaining 5.6 per cent of total reported emissions. The contribution of total reported greenhouse gas emissions by industrial sector is depicted in Figure 1.

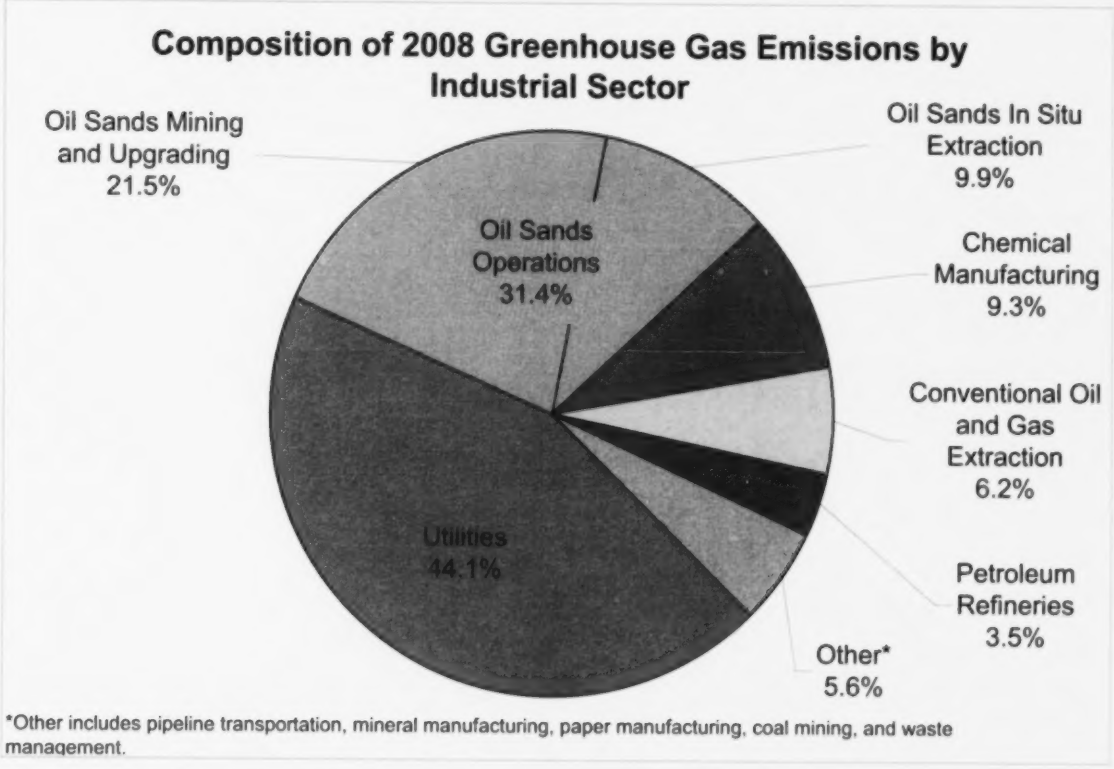
Composition of 2008 Greenhouse Gas Emissions by Industrial Sector
Oil Sands Mining and Upgrading 21.5%
Oil Sands In Situ Extraction 9.9%
Oil Sands Operations 31.4%
Chemical Manufacturing 9.3%
Conventional Oil and Gas Extraction 6.2%
Utilities 44.1%
Petroleum Refineries 3.5%
Other* 5.6%
*Other includes pipeline transportation, mineral manufacturing, paper manufacturing, coal mining, and waste management.

Figure 1: Total reported 2008 Alberta greenhouse gas emissions by industrial sector.

3.2 Total greenhouse gas emissions by gas type

The Alberta *Specified Gas Reporting Program* requires six greenhouse gases to be reported: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbon (HFC) species, perfluorocarbon (PFC) species, and sulphur hexafluoride (SF_6). The emitted mass of each gas is converted to carbon dioxide equivalent units using the global warming potential values detailed in the *Specified Gas Reporting Standard*, and summed to compute total emissions. Of the 109 Alberta facilities that reported greenhouse gas emissions to Alberta Environment, 108 facilities reported carbon dioxide emissions, 105 facilities reported methane, and 103 facilities reported nitrous oxide emissions.

The largest portion of reported greenhouse gas emissions by CO_2e is CO_2, contributing 96.4 per cent of the total with 106.9 Mt. The remainder consists of CH_4 (2.3 per cent or 2.6 Mt CO_2e), N_2O (1.2 per cent or 1.4 Mt CO_2e), HFCs (<0.1 per cent or 4 kt CO_2e) and SF_6 (<0.1 per cent or 0.2 kt CO_2e). No PFC emissions were reported for 2008. The contribution of total reported greenhouse gas emissions by gas type is depicted in Figure 2.

3.0 Reported 2008 Alberta greenhouse gas emissions

3.1 Total reported greenhouse gas emissions by sector

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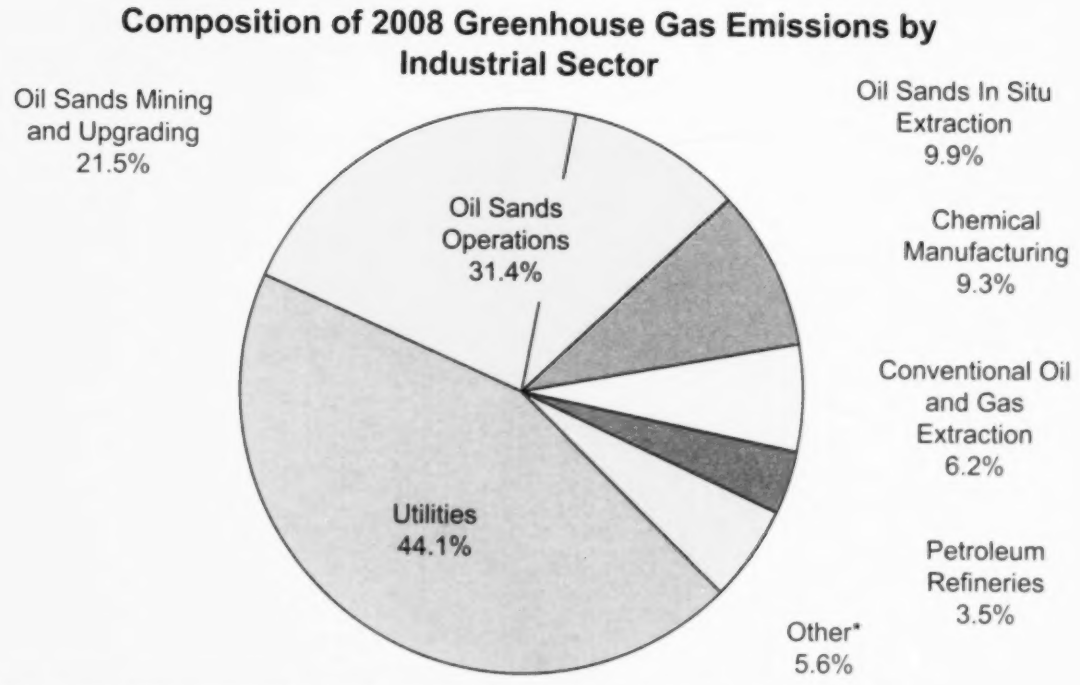
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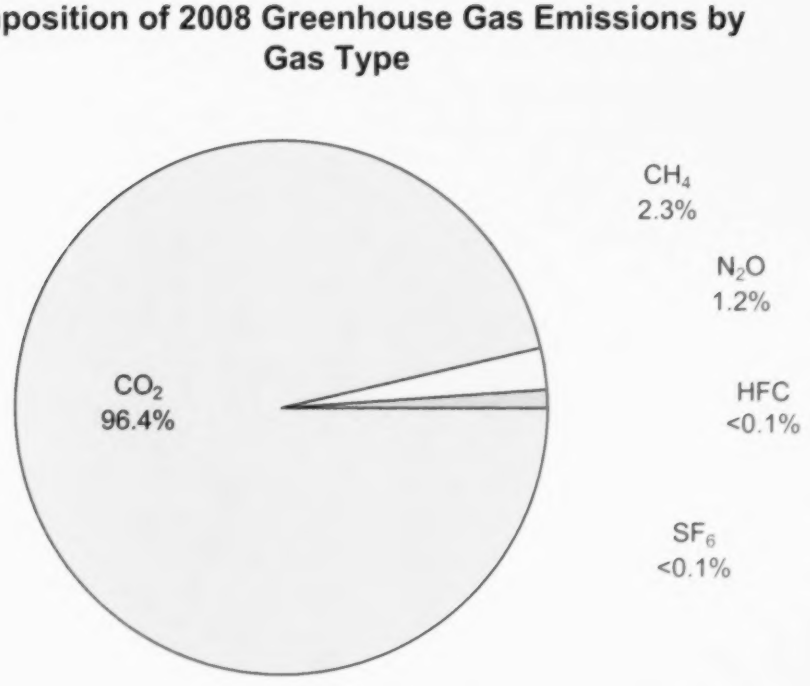
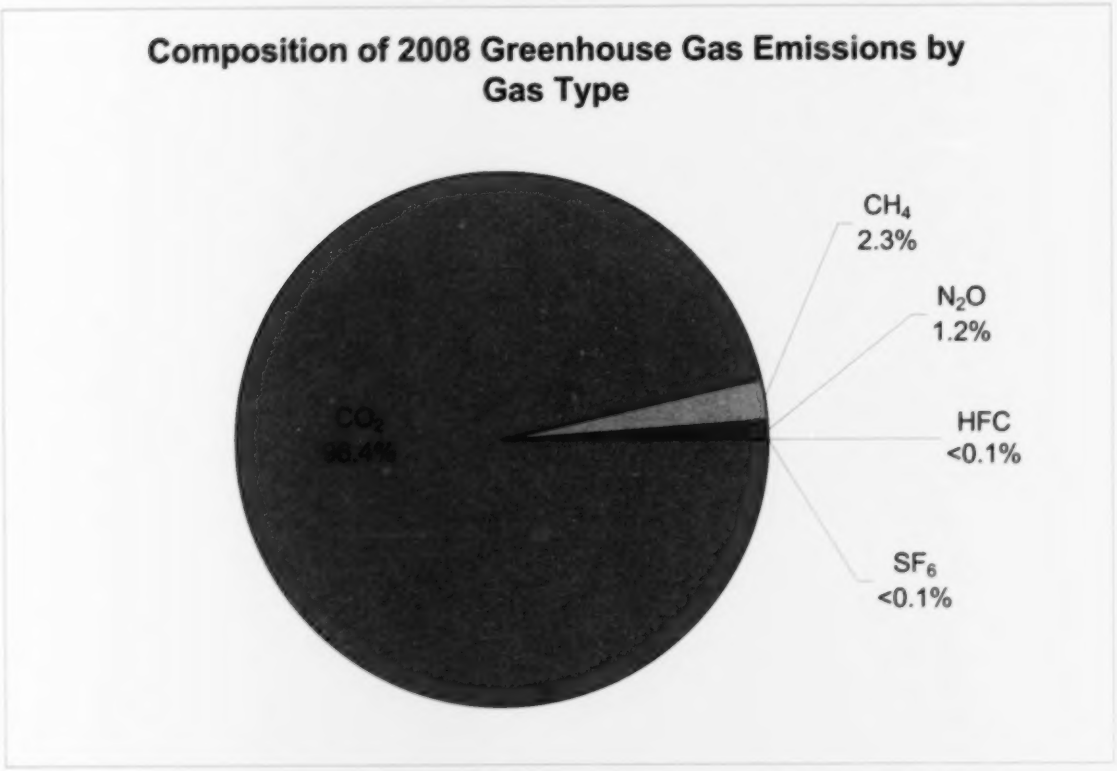


Figure 2: Total reported 2008 Alberta greenhouse gas emissions by gas type.

3.3 Distribution of total greenhouse gas emissions by facility

Among the 109 facilities in Alberta that reported greenhouse gas emissions for 2008, a varied distribution of emissions totals is observed at the facility level. Out of the 110.9 Mt CO2e total reported emissions, 90 per cent, or 100 Mt, was reported by 42 facilities, while the other 67 facilities account for the remaining 10 per cent. The eight largest emitters each reported greater than four megatonnes and together account for 60 per cent of total reported emissions. Of the eight largest emitters, five facilities are in the utilities sector, two are in the oil sands mining and upgrading sector, and one is in the oil sands in situ extraction sector. The distribution of 2008 total facility emissions in order of decreasing magnitude is shown in Figure 3.



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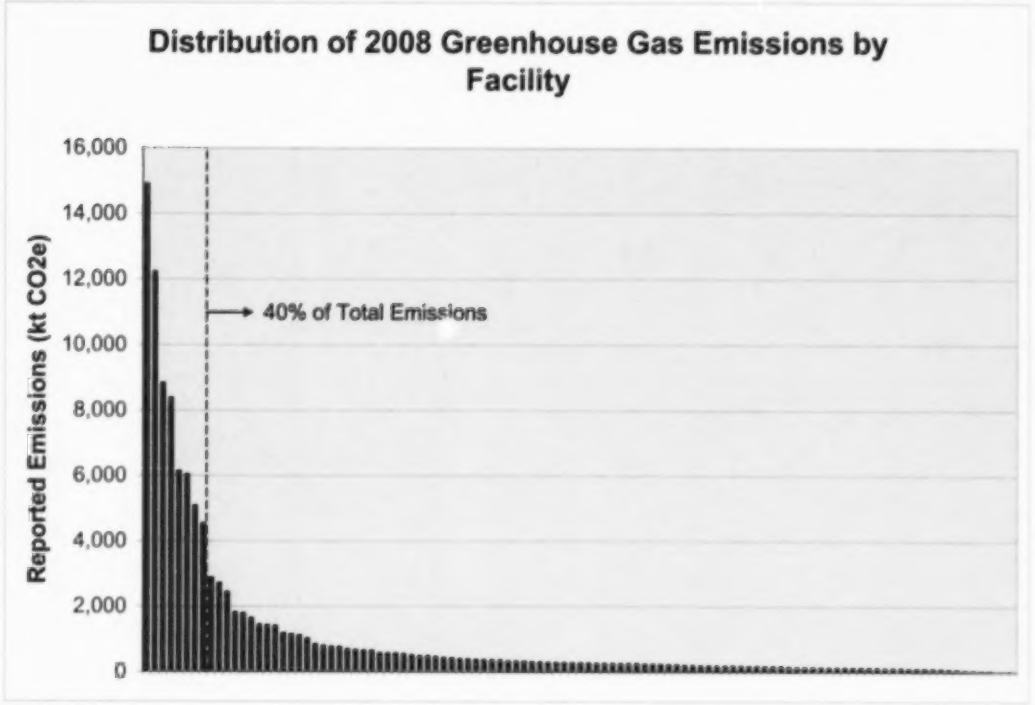

Figure 3: Distribution of reported 2008 Alberta greenhouse gas emissions by facility.

3.4 Reported emissions by industrial sector and gas type

While CO_2 contributed the largest portion of total reported emissions, the contribution from each greenhouse gas varied across industrial sectors, as shown in Figure 4. Carbon dioxide contributed more than 90 per cent of greenhouse gas emissions for seven industrial sectors, including utilities, oil sands mining and upgrading, oil sands in situ extraction, chemical manufacturing, conventional oil and gas extraction, petroleum refineries, and mineral manufacturing, and was the majority contributor in the pipeline transportation, coal mining, and paper manufacturing sectors. Methane was the majority greenhouse gas contrubitor in only one sector (waste management), but contributed greater than 10 per cent in the pipeline transportation, coal mining and paper manufacturing sectors. Nitrous oxide contributed 10 per cent of greenhouse gas emissions in the paper manufacturing sector, 6 per cent in chemical manufacturing, and less than 2 per cent in all other sectors. Emissions of HFCs and SF_6 were reported in small quantities and are excluded from Figure 4.

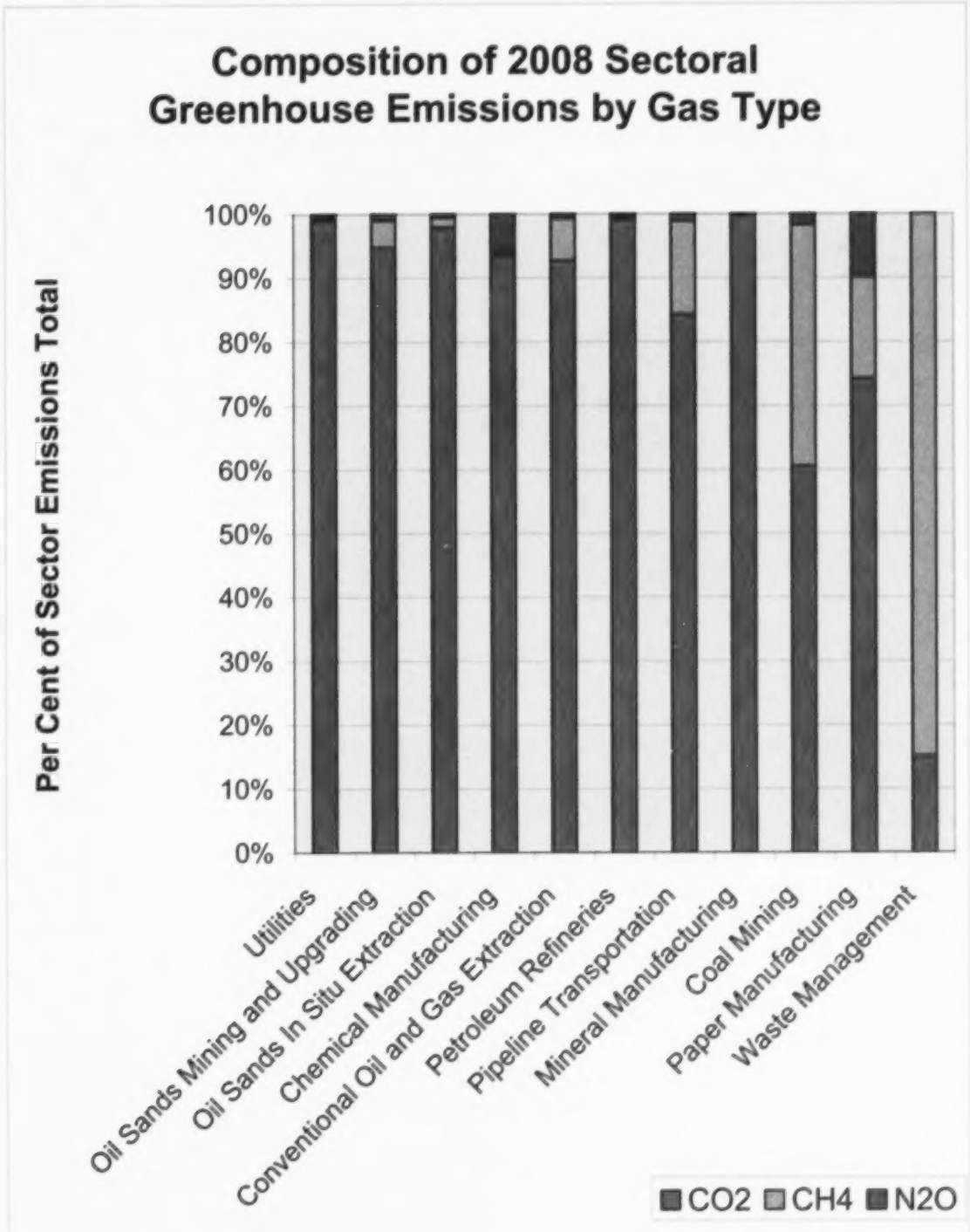

Figure 4: Reported 2008 greenhouse gas emissions for each industrial sector by gas type.

4.0 Reported 2008 Alberta greenhouse gas emissions by source category

The Alberta *Specified Gas Reporting Program* requires greenhouse gas emissions to be reported according to six source categories: stationary fuel combustion, industrial process, other fugitive, venting and flaring, on-site transportation, and waste and wastewater. A description of the source categories can be found in the Glossary of terms.

4.1 Total reported emissions by source category

Stationary fuel combustion was the largest source of greenhouse gases, emitting 94.4 Mt. The second largest source was industrial process, emitting 9.3 Mt. The remaining 6.5 per cent of total reported emissions was from venting/flaring, other fugitive, on-site transportation, and waste and wastewater sources. The contribution of each source category to the total 2008 reported emissions is shown in Figure 5.

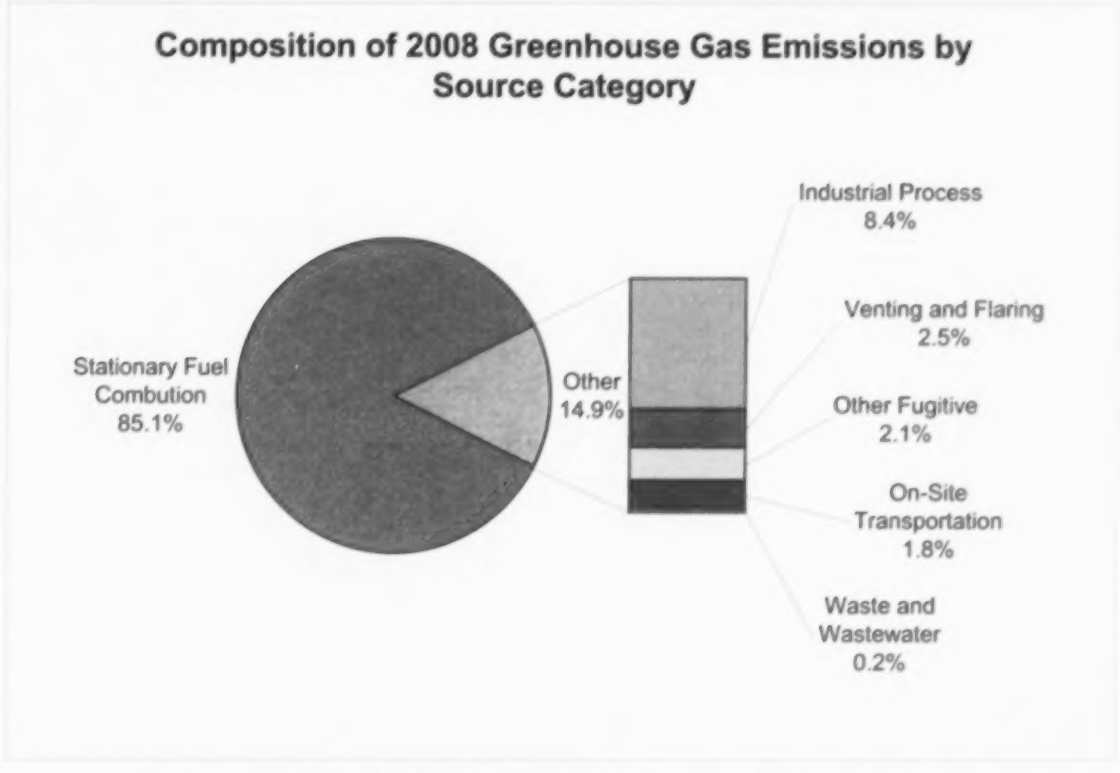
Composition of 2008 Greenhouse Gas Emissions by Source Category
Industrial Process 8.4%
Venting and Flaring 2.5%
Other Fugitive 2.1%
On-Site Transportation 1.8%
Waste and Wastewater 0.2%
Other 14.9%
Stationary Fuel Combution 85.1%

Figure 5: Total reported 2008 greenhouse gas emissions by source category.

4.2 Sectoral emissions by source category

In eight of eleven industrial sectors, stationary fuel combustion contributed the majority of greenhouse gas emissions. In the mineral manufacturing sector, industrial process emissions

were the majority contributor, largely on account of calcination reactions occurring at the facilities. Transportation emissions were the the majority contributor in the coal mining sector, primarily due to hauling of mined coal to processing facilities. By their nature, facilities in the waste management sector predominantly reported waste and wastewater emissions. The relative contribution of each source category to total reported emissions in each industrial sector is shown in Figure 6.

4.3 Source category emissions by industrial sector

The relative contribution of each industrial sector to total reported emissions in each source category is shown in Figure 7. The sectoral composition of stationary fuel combustion emissions appears to be very similar to the sectoral composition of total 2008 emissions shown in Figure 1. The utilities sector was the largest source of stationary fuel combustion emissions, followed by the oil sands mining and upgrading, oil sands in situ extraction, and chemical manufacturing sectors. This similarity is not surprising, since stationary fuel combustion was the dominant source of total emissions, as noted in Section 3.2. The largest contributors in the industrial process category were oil sands mining and upgrading and chemical manufacturing facilities, followed by mineral manufacturing, petroleum refineries, and conventional oil and gas extraction facilities. The largest portion of other fugitive emissions came from the oil sands mining and upgrading sector, and the largest portion of venting and flaring emissions came from the conventional oil and gas sector. The oil sands mining and upgrading sector and the coal mining sector contributed a combined 98.7 per cent of the total on-site transportation emissions. Finally, waste and wastewater emissions were similarly dominated by the waste management and paper manufacturing sectors.

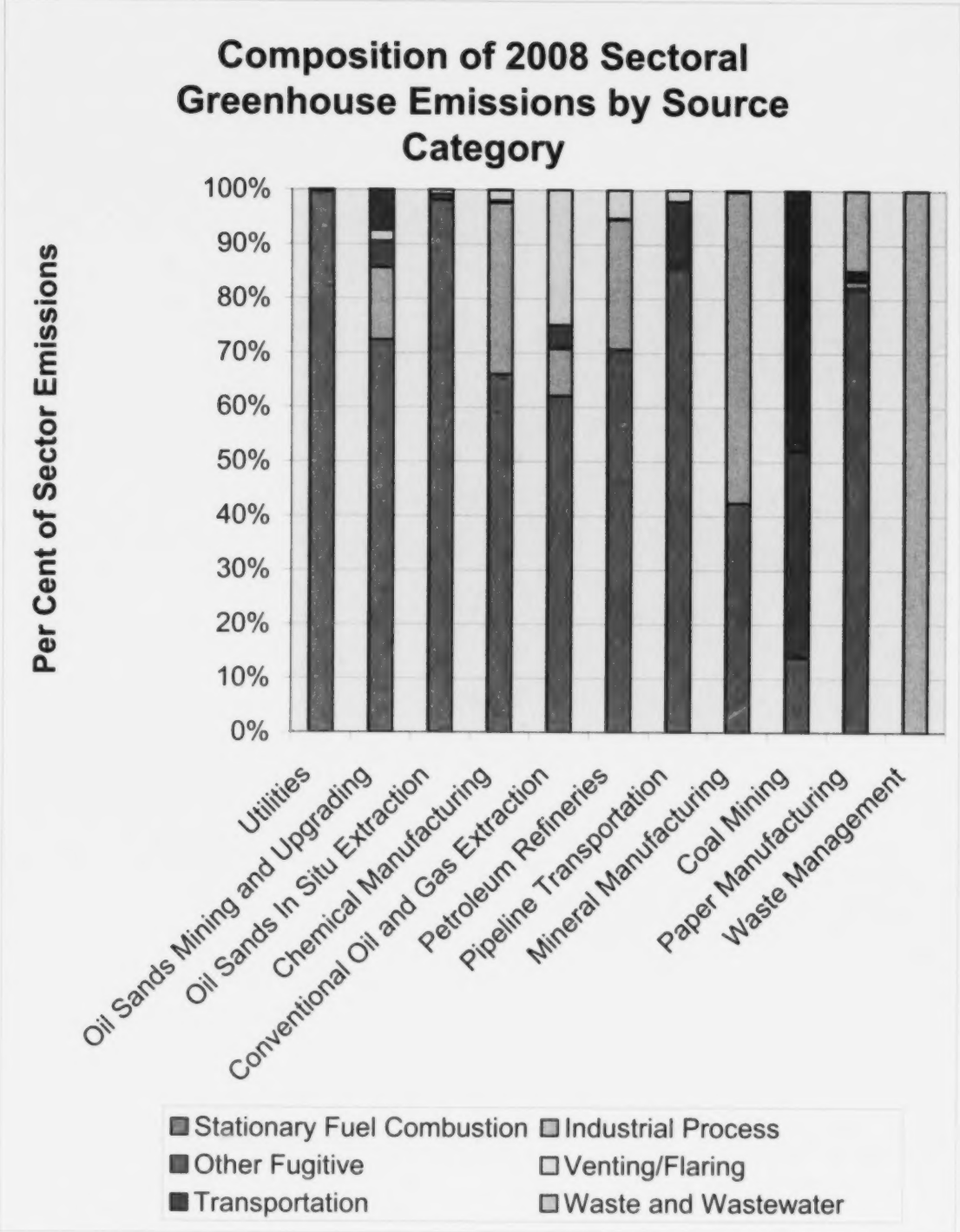

Figure 6: Total reported industrial sector emissions by source category.

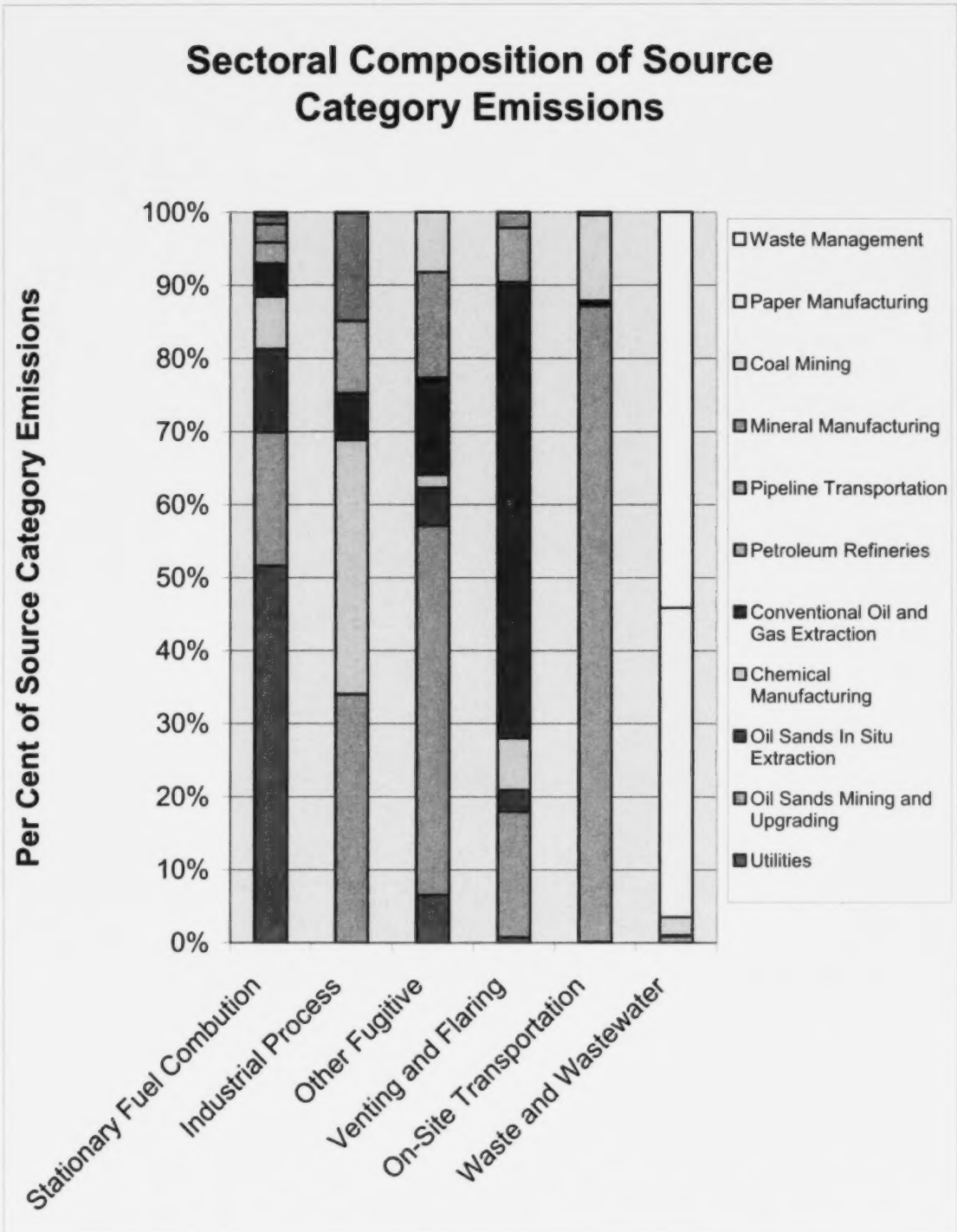

Figure 7: Total reported source category emissions by industrial sector.

5.0 Comparision with previous reporting periods

The 2008 calendar year marks the sixth year of mandatory greenhouse gas reporting for large industrial facilities in Alberta. The number of facilities reporting through the *Specified Gas Reporting Program* has increased every year since 2004. Along with this increase, additional variation exists in the annual facility list due to some facilities exceeding or falling below the reporting threshold in subsequent years, facilities decommissioning, and voluntary reporting. Short-term and long-term trends in reported greenhouse gas emissions in Alberta are investigated in this section.

Note: Comparability of reported emissions between reporting years is limited due to a lack of information regarding calculation methods used to calculate emissions inventories. Some change in facility emissions may be the result of methodology changes. Similarily, facilities are not required to use consistent calculation methods across industrial sectors, limiting facility-to-facility comparability. Finally, only emissions reported through the federal harmonized one-window Electronic Data Reporting System are included in this analysis, which excludes data received for 2003.

5.1 Short-term trend: comparison of 2007 and 2008 reported greenhouse gas emissions

Total reported greenhouse gas emissions from Alberta facilities decreased by 3.5 Mt, or 3 per cent, from 114.4 Mt to 110.9 Mt between the 2007 and 2008 reporting years. Concurrently, the number of facilities reporting greenhouse gase emissions increased from 106 to 109. By sector, the number of reports received increased in the coal mining, oil sands in situ extraction, oil sands mining and upgrading, and utilities sectors, decreased in the chemical manufacturing and conventional oil and gas sectors, and held constant in the remaining sectors. A comparison of total reported emissions and number of reports received by sector for 2007 and 2008 is shown in Table 2.

Table 2: Number of reports received and total reported emissions by sector for 2007 and 2008.

	Facilities Reporting		Emissions (kt CO2e)	
Sector	2007	2008	2007	2008
Chemical Manufacturing	16	15	10,097	10,270
Coal Mining	2	3	366	497
Conventional Oil and Gas Extraction	32	29	7,658	6,845
Mineral Manufacturing	6	6	2,408	2,403
Oil Sands In Situ Extraction	9	13	8,879	10,927
Oil Sands Mining and Upgrading	4	5	24,520	23,848
Paper Manufacturing	4	4	458	478
Petroleum Refineries	3	3	4,337	3,862
Pipeline Transportation	4	4	3,319	2,797
Utilities	25	26	50,287	48,903
Waste Management	1	1	90	90
Total	**106**	**109**	**112,419**	**110,921**

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The change in total reported emissions for each industrial sector is illustrated in Figure 8. Relatively small increases in sectoral emissions were reported in the chemical manufacturing, coal mining and paper manufacturing sectors. Decreases of a larger magnitude, but less than 1 Mt, were reported in the conventional oil and gas extraction, oil sands mining and upgrading, petroleum refineries, and pipeline transportation sectors. Negligible change was reported in the mineral manufacturing and waste management sectors. The most notable changes occurred in the oil sands in situ extraction and utilities sectors. An increase of over 2 Mt was reported by the oil sands in situ extraction sector, partly due to an increase of four additional reporting facilities, an increase of approximately 44 per cent. Reported emissions in the utilities sector decreased by greater than 1 Mt, despite the number of reporting facilities increasing by one.

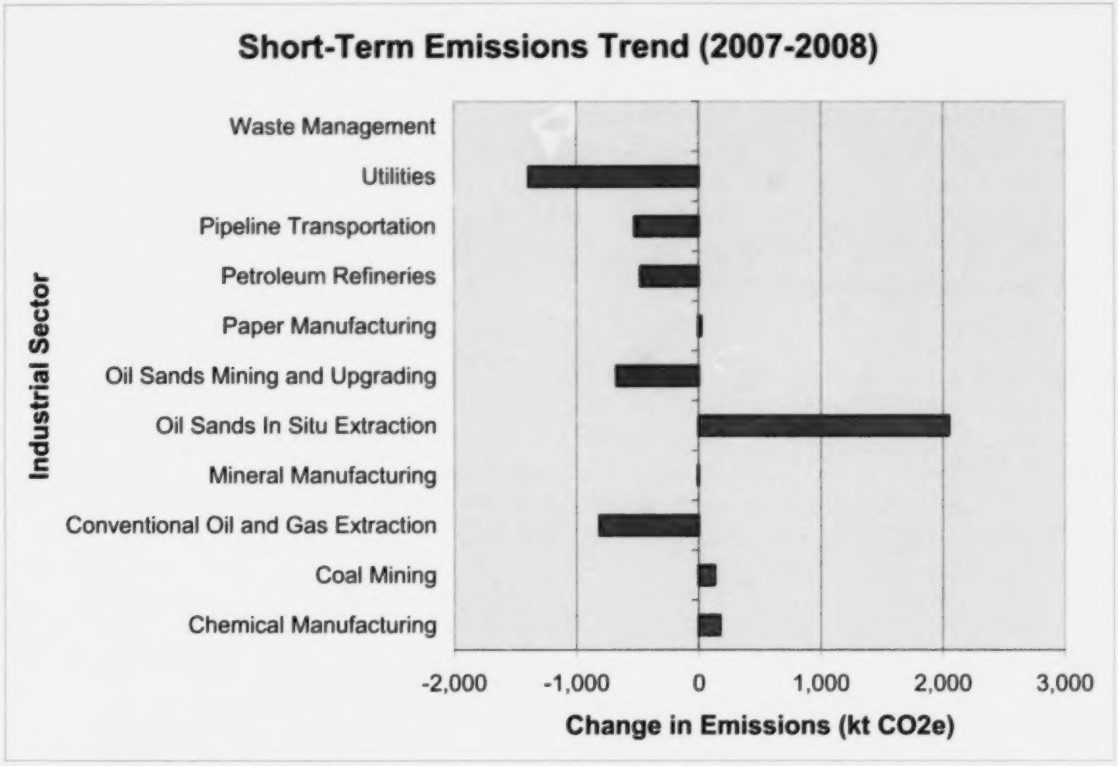

Figure 8: Change in total reported greenhouse gas emissions by industrial sector from 2007 to 2008.

5.2 Long-term trend: comparison of 2004 and 2008 reported greenhouse gas emissions

From 2004 to 2008, the total number of facilities in Alberta that reported greenhouse gas emissions increased from 98 to 109. Concurrently, the total reported emissions increased by 2.2 per cent from 108.5 Mt to 110.9 Mt. By sector, the largest changes in the number of facilities reporting were seen in the conventional oil and gas, oil sands in situ extraction, and utilities sectors. The increase from one to three facilities in the coal mining sector is also notable. A

comparison of total reported emissions and number of reports received by sector for 2004 and 2008 is shown in Table 3.

Table 3: Number of reports received and total reported emissions by sector for 2004 and 2008.

Sector	Facilities Reporting 2004	Facilities Reporting 2008	Emissions (kt CO_2e) 2004	Emissions (kt CO_2e) 2008
Chemical Manufacturing	14	15	11,335	10,270
Coal Mining	1	3	185	497
Conventional Oil and Gas Extraction	35	29	8,838	6,845
Mineral Manufacturing	4	6	2,409	2,403
Oil Sands In Situ Extraction	7	13	6,779	10,927
Oil Sands Mining and Upgrading	4	5	21,008	23,848
Paper Manufacturing	4	4	474	478
Petroleum Refineries	3	3	3,938	3,862
Pipeline Transportation	4	4	3,232	2,797
Utilities	21	26	49,442	48,903
Waste Management	1	1	84	90
Total	**98**	**109**	**107,724**	**110,921**

Some similarities noted in the short-term trend are also visible in the longer-term trend. For example, small or negligible changes in reported emissions are seen in the coal mining, mineral manufacturing, paper manufacturing, petroleum refineries and waste management sectors. The conventional oil and gas sector reported significant decreases in both the short term and the long term, and the oil sands in situ extraction sector similarly reported significant increases. In the conventional oil and gas sector, both reported greenhouse gas emissions and the number of reporting facilities has declined by greater than 15 per cent. In the oil sands in situ extraction sector, the number of facilities reporting has increased by 86 per cent, and the reported emissions have increased by 61 per cent. Other notable trends that are less consistent with the short-term observations include a moderate increase of emissions in the oil sands mining and upgrading sector, and a moderate decrease in the chemical manufacturing sector.

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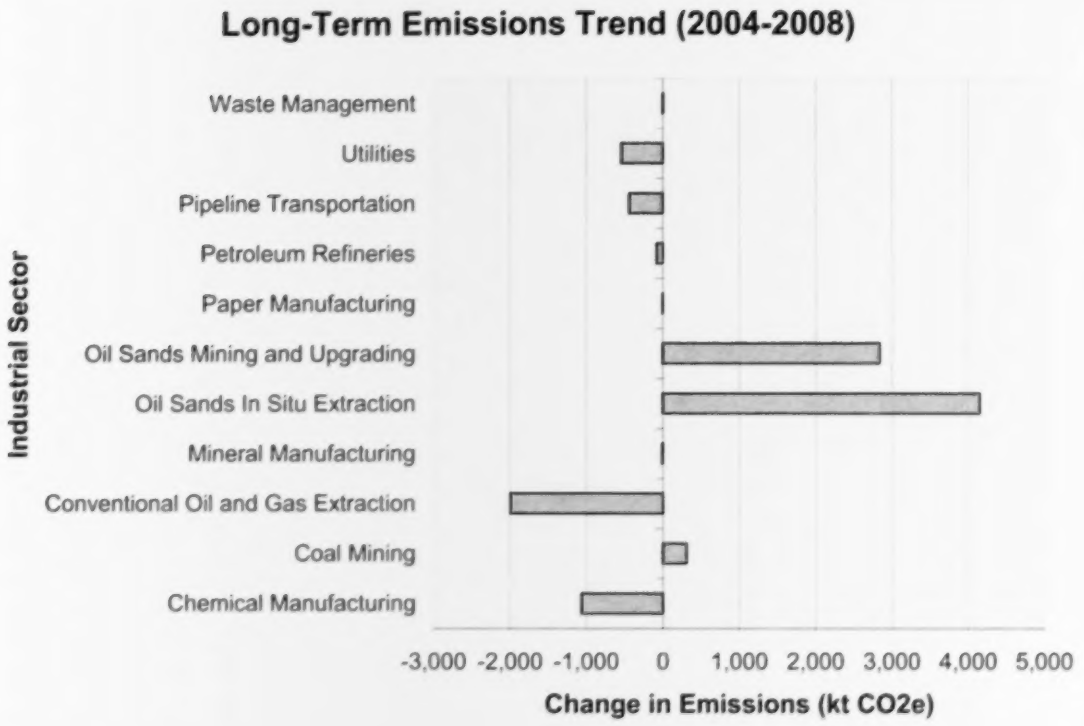


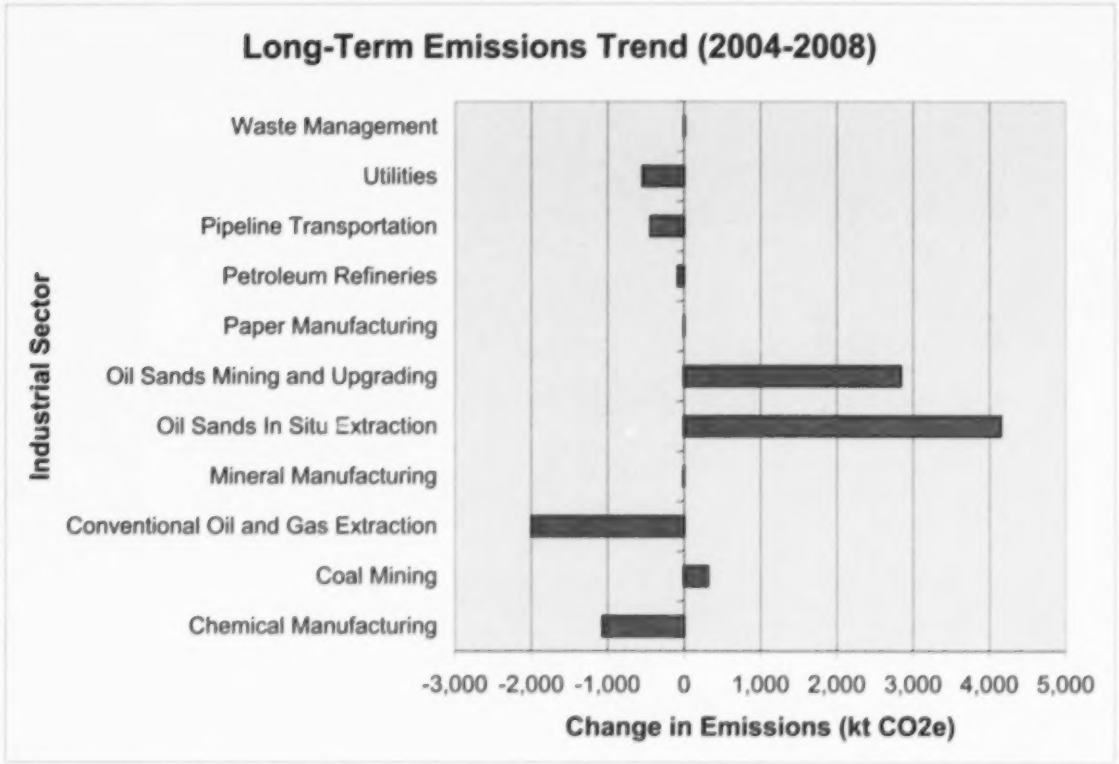
Figure 9: Change in reported total greenhouse gas emissions by sector from 2004 to 2008.

5.3 Comparable facilities

With a mandatory reporting threshold of 100,000 tonnes, it is sometimes meaningful to remove the effects of voluntary reporting and facilities rising and falling below the threshold. For this purpose, the concept of comparable facilities is used. Comparable facilities are all facilities that have reported greenhouse gas emissions in every year from 2004 to 2008, of which there are 82. The total annual reported emissions from 2004 to 2008, for comparable facilities, are shown in Table 4. In the short term, the reported greenhouse gas emissions have decreased from 109.0 Mt in 2007 to 105.5 Mt in 2008, but have increased slightly from 104.6 Mt in 2004.

Table 4: Total annual reported greenhouse gas emissions for comparable facilities in Alberta.

	2004	2005	2006	2007	2008
Total Reported Emissions (Mt CO_2e)	104.6	103.9	110.7	109.0	105.5



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Total Reported Emissions (Mt CO_2e)	104.6	103.9	110.7	109.0	105.5

6.0 National reported greenhouse gas emissions

This section of the report examines the 2008 greenhouse gas emissions data collected through the harmonized one-window Electronic Data Reporting System for all of Canada.

6.1 2008 reported greenhouse gas emissions by province

A total of 262.6 Mt of greenhouse gas emissions were reported by large industrial facilities in Canada for the 2008 reporting period. The proportional contribution from provinces and territories to the national reported emissions is shown in Figure 10. The 109 facilities located in Alberta were the source of the largest portion of total reported greenhouse gas emissions with 42.2 per cent of the total. Facilities in Ontario were the next largest source of reported Canadian greenhouse gas emissions with 25.5 per cent of the total (66.9 Mt). Facilities in Saskatchewan and Quebec accounted for 8.3 and 7.6 per cent of total, at 21.8 Mt and 20.0 Mt, respectively. Facilities in British Columbia contributed 5.0 per cent of the total (13.2 Mt), facilities in Nova Scotia 4.2 per cent (11.1 Mt), and facilities in New Brunswick 3.9 per cent (10.3 Mt). The remaining provinces and territories contributed a combined total of 3.2 per cent of reported emissions (8.3 Mt). Combining the remaining provinces and territories contributed 30.8 Mt or 11 per cent of total reported Canadian greenhouse gas emissions. This combination includes Newfoundland and Labrador, Manitoba, the Northwest Territories, Nunavut, the Yukon and Prince Edward Island.

6.2 2007 facility greenhouse gas emissions as a portion of total provincial emissions

It is important to note that emissions reported through the *National Mandatory Greenhouse Gas Reporting Program* represent only a fraction of total greenhouse gas emissions from each province. Total greenhouse gas emissions for Canada and each province/territory are described in the *National Inventory Report 1990-2007*, published by Environment Canada. For 2007, the emissions reported through the mandatory industrial reporting program as a portion of total provincial emissions described in the inventory is shown in Figure 11. Greenhouse gas emissions from large industrial facilities represent varying fractions of the provincial inventory, as high as 58 per cent for New Brunswick and as low as 5 per cent for Prince Edward Island.

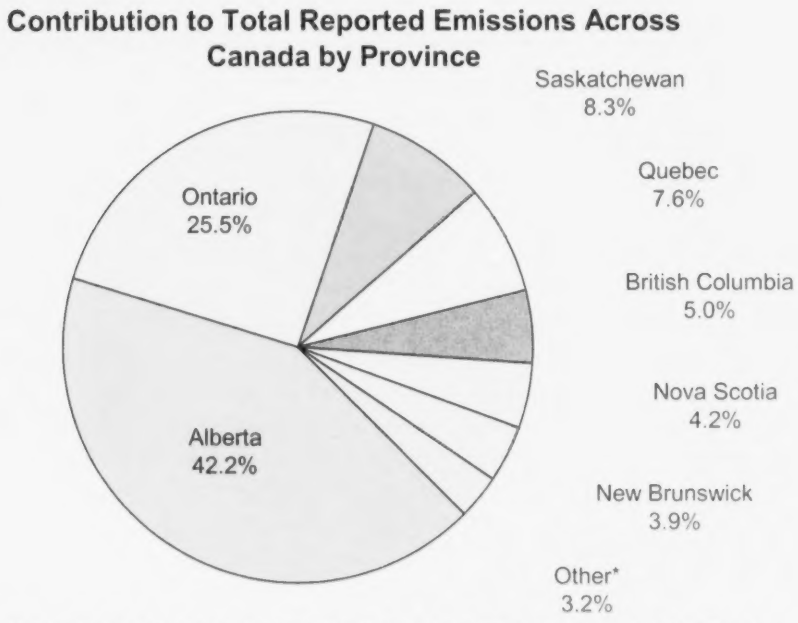
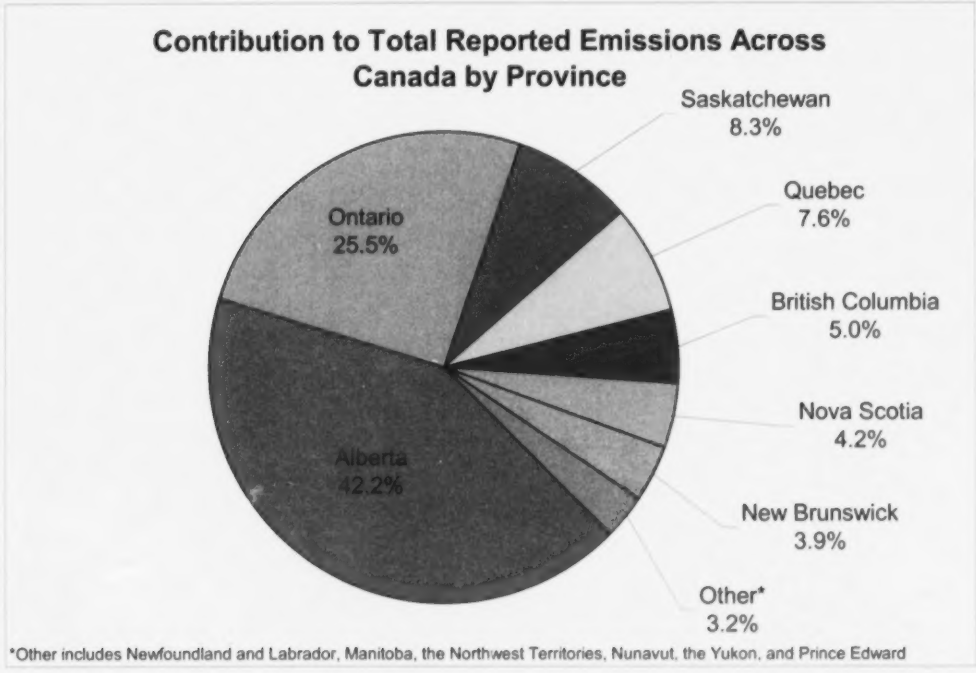

Contribution to Total Reported Emissions Across Canada by Province
Saskatchewan 8.3%
Quebec 7.6%
British Columbia 5.0%
Nova Scotia 4.2%
New Brunswick 3.9%
Other* 3.2%
Ontario 25.5%
Alberta 42.2%
*Other includes Newfoundland and Labrador, Manitoba, the Northwest Territories, Nunavut, the Yukon, and Prince Edward

Figure 10: Total reported greenhouse gas emissions across Canada by Province/Territory.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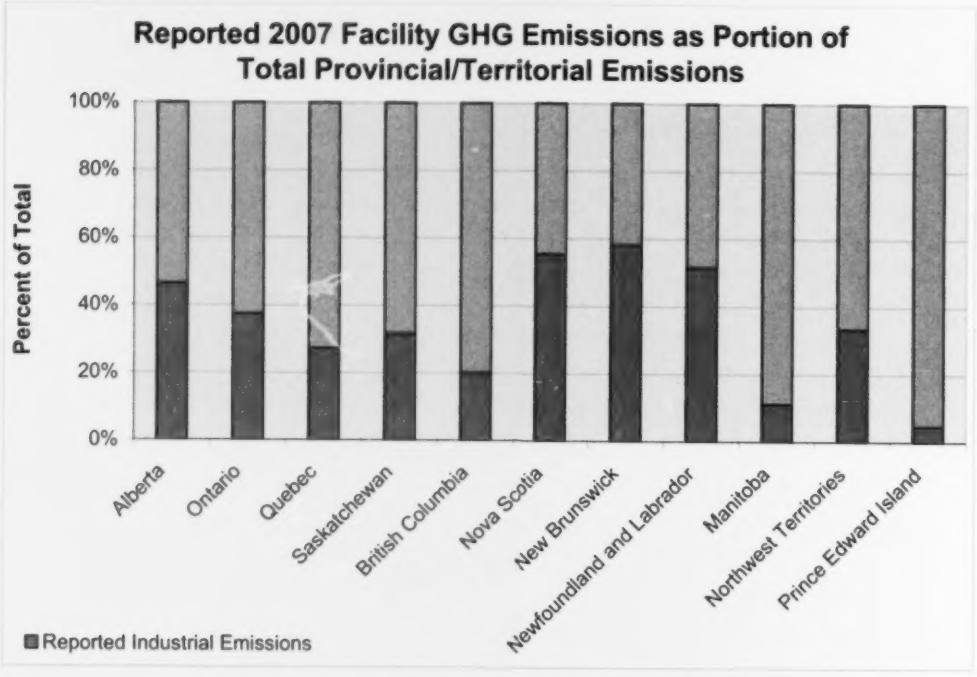


Figure 11: Reported 2007 facility greenhouse gas emissions as a percentage of total provincial/territorial emissions.

7.0 Data confidentiality and access

7.1 Confidentiality request process

The *Specified Gas Reporting Regulation* sets out confidentiality provisions for data collected under the *Regulation*. Section 5 of the *Regulation* permits facilities subject to the *Regulation* to request confidentiality for some or all of the information in their specified gas report. Confidentiality may be requested and granted for up to five years if the information is proved to be commercial, financial, scientific or technical information that would reveal proprietary business, competitive or trade secret information about a specific facility, technology or corporate initiative. The request from the facility needs to state exactly what is being requested to be held confidential and for what reasons it should be deemed confidential.

The following factors are considered during the confidentiality review process:

- Whether disclosure could reasonably be expected to significantly harm the competitive position of the specified gas reporter;
- Whether disclosure could reasonably be expected to interfere significantly with the negotiating position of the specified gas reporter;
- Whether disclosure could reasonably be expected to result in undue financial loss or gain to any person or organization;
- The availability of the information from other public sources; and
- Whether there are any other competing interests that would suggest disclosure of the information is warranted.

The Director under the *Climate Change and Emissions Management Act* has 90 days to review and reach a decision on each confidentiality request. The Director can also grant a portion or the entire request by deeming the information to be held as confidential for up to five years. Decisions on the 2008 confidentiality requests were made by August 29, 2009 and letters were sent to the designated certifying official of the requesting facility to inform them of the decision.

Section 8 of the *Regulation* requires the designated Director to submit a report on confidentiality requests to the Information and Privacy Commissioner. In accordance with the *Regulation*, the report must contain: the number of confidentiality requests received, number of confidentiality requests approved and the period of time prescribed for each approved request. The confidentiality process is outlined in Figure 12.

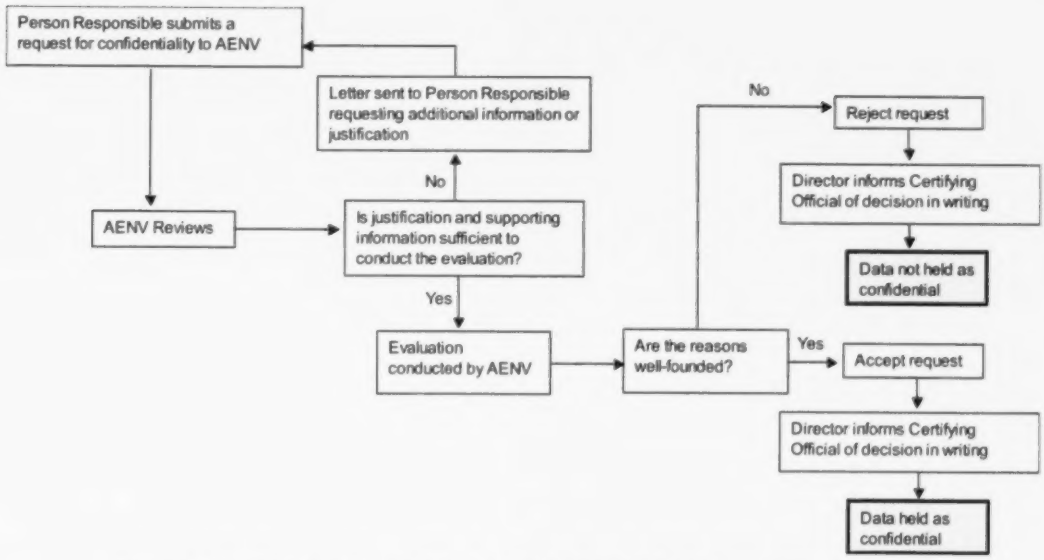

Person Responsible submits a request for confidentiality to AENV
Letter sent to Person Responsible requesting additional information or justification
No
AENV Reviews
Is justification and supporting information sufficient to conduct the evaluation?
Yes
Evaluation conducted by AENV
Are the reasons well-founded?
No
Reject request
Director informs Certifying Official of decision in writing
Data not held as confidential
Yes
Accept request
Director informs Certifying Official of decision in writing
Data held as confidential

Figure 12: Confidentiality process for the *Specified Gas Reporting Program*.

7.2 2008 confidentiality requests and decisions

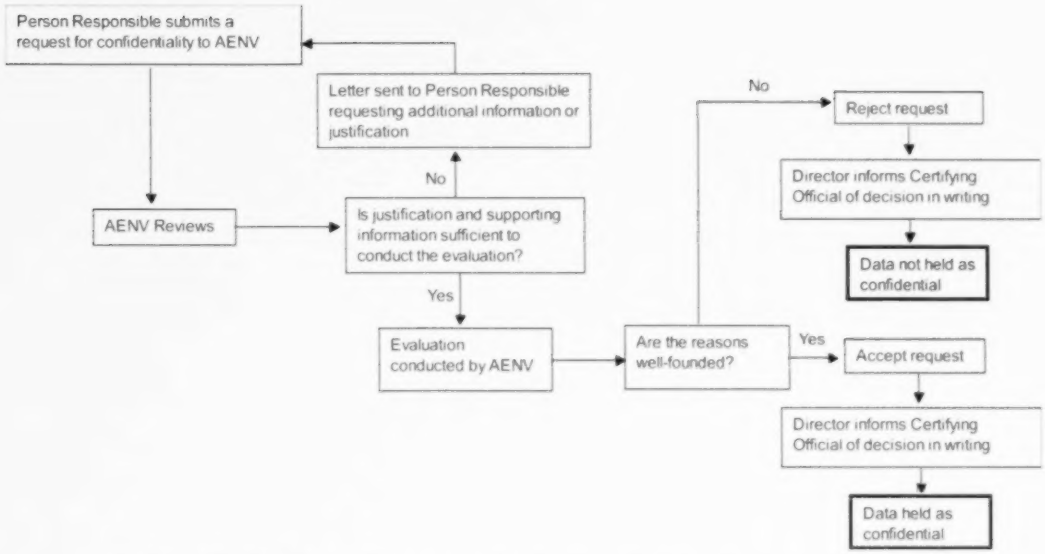
There were seven Alberta facilities that submitted a confidentiality request to Alberta Environment for 2008 specified gas reporting. All seven facilities requested that section III (A) of their specified gas report be kept confidential. Section III (A) of the 2008 specified gas report contains detailed greenhouse gas emissions by source category. The Director granted confidentiality for six of the requests and refused one request. Table 5 shows the facilities that requested confidentiality for 2008 and the corresponding decision by the Director.

Table 5: Confidentiality request decisions for 2008 greenhouse gas data.

Company Name	Facility Name	Decision
Imperial Oil	Cold Lake	Section III (A) deemed confidential for 5 years.
Petro-Canada	Edmonton Refinery	Section III (A) deemed confidential for 5 years.
Graymont	Exshaw	Section III (A) deemed confidential for 5 years.
Shell Canada Limited	Scotford Upgrader and Upgrader Cogen	Section III (A) deemed confidential for 5 years.
Shell Canada Limited	Shell Scotford Refinery	Section III (A) deemed confidential for 5 years.
Imperial Oil	Strathcona Refinery	Section III (A) deemed confidential for 5 years.
Air Products	Edmonton Hydrogen	Section III (A) not deemed confidential.

7.3 Publishing greenhouse gas data

Section 7 of the *Specified Gas Reporting Regulation* permits the Director to publish data and information in any specified gas report in any form or manner the Director considers appropriate.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Evaluation conducted by AENV
Are the reasons well-founded?
No
Reject request
Director informs Certifying Official of decision in writing
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Alberta Environment has published an annual report on the results of the *Specified Gas Reporting Program* since 2003 when the mandatory greenhouse gas reporting program began.

7.4 Requesting greenhouse gas data

Written requests for information contained in a submitted specified gas report that has not been deemed confidential can be submitted to the designated Director at AENV.GHG@gov.ab.ca. The Director shall respond to these requests within a reasonable amount of time. The process for requesting non-confidential greenhouse gas data from Alberta Environment is outlined in .

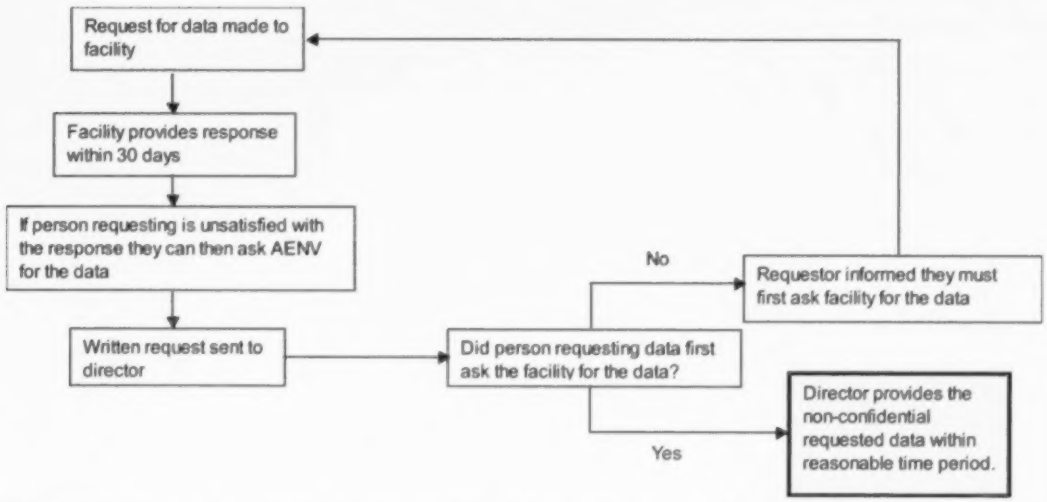
Request for data made to facility
Facility provides response within 30 days
If person requesting is unsatisfied with the response they can then ask AENV for the data
Written request sent to director
Did person requesting data first ask the facility for the data?
No
Requestor informed they must first ask facility for the data
Yes
Director provides the non-confidential requested data within reasonable time period.

Figure 13: Process for requesting non-confidential greenhouse gas data from Alberta Environment.

Glossary of terms

Biomass: Plant materials, animal waste or any product made of either of these and includes without limitation wood and wood products, charcoal, agricultural residues and wastes including organic material above and below ground, both living and dead, such as trees, crops, grasses, tree litter, roots, municipal and industrial wastes where the organic material is biological in origin, landfill gas, bio-alcohols, black liquor, sludge gas, animal or plant-derived oils.

Carbon dioxide (CO_2): Carbon dioxide is a colourless, odourless gas found in the air. It is absorbed by plants and exhaled by animals. Carbon dioxide is also a greenhouse gas that traps infrared radiation in the atmosphere. The main human activity that produces carbon dioxide is the combustion of fossil fuels such as coal, oil, natural gas in power plants, vehicles and industrial facilities.

Carbon dioxide equivalent (CO_2e): Carbon dioxide equivalent is the concentration of CO_2 that would cause the same amount of absorption of infrared radiation in the atmosphere as another greenhouse gas. CO_2e is calculated by multiplying the emissions of a greenhouse gas by an established global warming potential to get an equivalent quantity of carbon dioxide. Using CO_2e permits the calculation of total greenhouse gas emissions for a particular source.

Direct emission: The release of specified gases from sources actually located at a facility, expressed in tonnes on a CO_2e basis.

Electronic Data Reporting System: The Electronic Data Reporting System is a one-window secure web-based reporting tool for facilities to report greenhouse gas emissions to under the *Specified Gas Reporting Program* and the *National Mandatory Greenhouse Gas Reporting Program.*

Emissions: Emissions are a quantity of a substance that is released to the air from a source.

Emissions intensity: Emissions intensity is the ratio of greenhouse gas emission values to associated production values. Production values can include Gross Domestic Product, barrels of oil, tonne of coal, megawatt hour of electricity, or other appropriate metrics.

Facility: Any plant, structure or thing where an activity listed in Section 2 of the Schedule of Activities to the *Environmental Protection and Enhancement Act* occurs, and a site or one or more contiguous or adjacent sites that are operated and function in an integrated fashion where an activity listed in any of Sections 3 to 11 of the Schedule of Activities to the *Environmental Protection and Enhancement Act* occurs, including all the buildings, equipment, structures, machinery and vehicles that are an integral part of the activity.

Flaring emissions: Flaring emissions are direct emissions from the controlled combustion of a gas or liquid stream produced on site not for the purpose of producing energy and includes without limitation emissions arising from waste petroleum incineration, hazardous emissions prevention systems (whether in pilot or active mode), well testing, natural gas gathering systems,

processing plant operations, crude oil production, pipeline operations, petroleum refining and chemical fertilizer and steel production.

Global warming potential: Global warming potential is the relative measure of the warming effect that the emission of a specified gas might have on the Earth's atmosphere calculated as the ratio of the time-integrated radiative forcing that would result from the emission of one kilogram of a given specified gas to that from the emission of one kilogram of carbon dioxide.

Greenhouse gases: Greenhouse gases are any gas that absorbs infrared radiation in the Earth's atmosphere. Greenhouse gases can come from both natural and human activities. Common greenhouse gases that result from human activities include carbon dioxide, methane and nitrous oxide.

Hydrofluorocarbons (HFCs): Hydrofluorocarbons are synthetic industrial gases emitted in small quantities but are powerful greenhouse gases with global warming potentials of hundreds to thousands of times that of carbon dioxide. Hydrofluorocarbons include the following HFC Species: CHF_3, CH_2F_2, CH_3F, $C_5H_2F_{10}$ (structure: $CF_3CHFCHFCF_2CF_3$), C_2HF_5, $C_2H_2F_4$ (structure: CHF_2CHF_2), $C_2H_2F_4$ (structure: CH_2FCF_3), $C_2H_3F_3$ (structure: CHF_2CH_2F), $C_2H_3F_3$ (structure: CF_3CH_3), $C_2H_4F_2$ (structure: CH_3CHF_2), C_3HF_7 (structure: CF_3CHFCF_3), $C_3H_2F_6$ (structure: $CF_3CH_2CF_3$) and $C_3H_3F_5$ (structure: $CH_2FCF_2CHF_2$). Only HFC emissions from industrial process and industrial product use are reported under the *Specified Gas Reporting Program*. Sources of HFC emissions from industrial process and industrial product use include emissions from foam blowing and the use of HFC as a cover gas in metal production. HFC emissions from other applications such as refrigeration, air conditioning, aerosol propellants, fire extinguishers, some solvents, etc, are not considered industrial process or industrial product use and are not reported under the *Specified Gas Reporting Regulation*.

Industrial process emissions: Direct emissions from an industrial process involving chemical or physical reactions, other than combustion, and where the primary purpose of the industrial process is not energy production. This includes mineral, metal and chemical production. This source category is more sector-specific than stationary fuel combustion and is not found in all industrial sectors.

Kilotonne: One thousand tonnes. Designated by kt.

Megatonne: One million tonnes. Designated by Mt.

Methane (CH_4): Methane is a colourless, odourless, flammable gas formed naturally by the decomposition of organic matter. Methane is also a greenhouse gas that traps infrared radiation in the atmosphere. Methane has a global warming potential 21 times that of carbon dioxide. Natural sources of methane include wetlands, permafrost, termites, water bodies and forest fires. Methane is also a hydrocarbon gas and is the principal constituent of natural gas. Human activities that are sources of methane emissions include fossil fuel production, animal husbandry, rice cultivation, biomass burning, and waste management.

Nitrous oxide (N_2O): Nitrous oxide is a colourless, non-flammable gas with a sweet odour. Nitrous oxide is also a powerful greenhouse gas that traps infrared radiation in the atmosphere. Nitrous oxide has a global warming potential 310 times that of carbon dioxide. Nitrous oxide is produced naturally from a wide variety of biological sources in soil and water, particularly microbial action in wet tropical forests. Human activities that are sources of nitrous oxide include agricultural soil management, animal manure management, sewage treatment, mobile and stationary combustion of fossil fuel, and some chemical production.

On-site transportation emissions: On-site transportation is a greenhouse gas source category with direct emissions resulting from fuel combustion in machinery used for the on-site transportation of products and material integral to the production process. Examples are the transportation of raw or intermediate products and materials within the production process; such as equipment used at an oil sands operation to mine and/or move materials to subsequent on-site processing, or equipment used at above or below ground mining operations to mine and/or move mined materials or other intermediate products or materials to different on-site production processes.

Other fugitive emissions: Other fugitive emissions are direct emissions that do not fall under stationary fuel combustion emissions, industrial process emissions, venting emissions, flaring emissions, on-site transportation emissions, or waste and wastewater emissions and includes without limitation intentional or unintentional releases of gases arising from the production, processing, Rtransmission, storage and use of solid, liquid or gaseous fuels. In general, emissions from other fugitive sources are a result of the handling or processing of various types of fuel in the fossil fuel industry. Other fugitive sources include leaks from natural gas transmission lines and processing plants, accidental releases from oil and gas wells and releases from the mining and handling of coal.

Perfluorocarbons (PFCs): Perfluorocarbons are synthetic industrial gases emitted in small quantities but are powerful greenhouse gases with global warming potential of hundreds to thousands of times that of carbon dioxide. Perfluorocarbons include the following PFC species: CF_4, C_2F_6, C_3F_8, C_4F_{10}, c-C_4F_8, C_5F_{12}, and C_6F_{14}. Only PFC emissions from industrial process and industrial product use are reported under the *Specified Gas Reporting Program*. Sources of PFC emissions from industrial process and industrial product use include aluminum production and foam blowing.

Specified gas: Specified gases are those identified in the *Specified Gas Reporting Regulation*. This includes: carbon dioxide, methane, nitrous oxide, species of hydrofluorocarbons, species of perfluorocarbons and sulphur hexafluoride.

Stationary fuel combustion emissions: Stationary fuel combustion emissions are direct emissions resulting from non-vehicular combustion of fossil or biomass fuel for the purpose of producing energy but do not include biomass combustion CO_2 emissions. Stationary fuel combustion is a common source of greenhouse gas emissions and is produced in most industrial sectors. The stationary fuel combustion source category includes on-site waste incineration if the waste is combusted for the purpose of energy production.

Sulphur hexafluoride (SF_6): Sulphur hexafluoride is a synthetic industrial gas that is emitted in small quantities but is a powerful greenhouse gas with a global warming potential thousands of times that of carbon dioxide. Only SF_6 emissions from industrial process and industrial product use are reported under the *Specified Gas Reporting Program*. Sources of SF_6 from industrial process and industrial product use are uses such as a cover gas in magnesium smelting and casting, as foundry products in the aluminum industry, or as an insulting gas in electrical equipment such as circuit breakers. SF_6 emissions from other applications such as fire suppression, explosion protection, leak detection and electronic applications are not considered industrial process or industrial product use and are not reported under the *Regulation*.

Venting emissions: Venting emissions are direct emissions from intentional releases to the atmosphere of a waste gas or liquid stream and includes without limitation emissions of casing gas, associated (or solution) gas, treater, stabilizer, dehydrator off-gas, blanket gas and emissions from pneumatic devices which use natural gas as a driver, compressor start-up, pipeline and other blowdowns and metering and regulation station control loops.

Waste and wastewater emissions: Waste and wastewater emissions are direct emissions from disposal of waste and waste or wastewater treatment and includes without limitation sources of emissions from on-site waste disposal and waste or wastewater treatment at a facility such as landfilling of solid waste, flaring of landfill gas, treatment of liquid waste and waste incineration.

Appendix

Table 6: All reported 2008 greenhouse gas emissions for Alberta facilities.

Sector	Facility Name	Reporting Company	CO2 (t CO2e)	CH4 (t CO2e)	N2O (t CO2e)	HFC (t CO2e)	SF6 (t CO2e)	Total (t CO2e)
Chemical Manufacturing	Agrium Redwater Fertilizer Operation	Agrium Inc.	1,144,570	15,969	13,879	0	0	1,174,418
Chemical Manufacturing	Alberta Envirofuels Inc.	Alberta Envirofuels Inc.	278,726	614	1,725	0	0	281,064
Chemical Manufacturing	Canadian Fertilizers Limited	Canadian Fertilizers Limited	1,635,508	348	4,919	0	0	1,640,776
Chemical Manufacturing	Cancarb Ltd.	Cancarb Ltd.	117,209	2,590	401	0	5	120,205
Chemical Manufacturing	Carseland Nitrogen Operations	Agrium Inc	513,130	14,053	2,080	0	0	529,264
Chemical Manufacturing	Carseland Works	Orica Canada Inc	556	14	555,856	0	0	556,426
Chemical Manufacturing	Edmonton Hydrogen Facility	Air Products Canada Ltd	648,319	188	930	0	0	649,437
Chemical Manufacturing	Fort Saskatchewan Nitrogen Operation	Agrium Inc.	507,100	805	1,583	0	0	509,488
Chemical Manufacturing	FS1 EOEG	MEGlobal Canada Inc.	72,500	902	0	0	0	73,402
Chemical Manufacturing	Joffre LAO Plant	INEOS Canada Partnership	103,160	76	567	0	0	103,803
Chemical Manufacturing	NOVA Chemicals Corporation (Joffre)	NOVA Chemicals Corporation	2,695,556	2,656	12,013	0	96	2,710,321
Chemical Manufacturing	Prentiss Manufacturing Facility	Dow Chemical Canada ULC	37,452	530	28	0	0	38,009
Chemical Manufacturing	Prentiss Manufacturing Facility	MEGlobal Canada Inc.	167,899	972	244	0	0	169,114
Chemical Manufacturing	Scotford Chemical Plant	Shell Chemicals Canada Ltd	316,373	214	789	1,855	0	319,230
Chemical Manufacturing	Western Canada Operations	Dow Chemical Canada ULC	1,387,461	1,815	3,342	2,080	0	1,394,698
Coal Mining	Cheviot Mine (Cardinal River Operations)	Cardinal River Coals Limited (Teck Coal Limited)	70,112	26,118	6,384	0	0	102,614
Coal Mining	Coal Valley Mine	Coal Valley Resources Inc.	132,383	41,063	992	0	0	174,438

Appendix

Table 6: All reported 2008 greenhouse gas emissions for Alberta facilities.

Sector	Facility Name	Reporting Company	CO2 (t CO2e)	CH4 (t CO2e)	N2O (t CO2e)	HFC (t CO2e)	SF6 (t CO2e)	Total (t CO2e)
Chemical Manufacturing	Agrium Redwater Fertilizer Operation	Agrium Inc.	1,144,570	15,969	13,879	0	0	1,174,418
Chemical Manufacturing	Alberta Envirofuels Inc.	Alberta Envirofuels Inc.	278,726	614	1,725	0	0	281,064
Chemical Manufacturing	Canadian Fertilizers Limited	Canadian Fertilizers Limited	1,635,508	348	4,919	0	0	1,640,776
Chemical Manufacturing	Cancarb Ltd.	Cancarb Ltd.	117,209	2,590	401	0	5	120,205
Chemical Manufacturing	Carseland Nitrogen Operations	Agrium Inc	513,130	14,053	2,080	0	0	529,264
Chemical Manufacturing	Carseland Works	Orica Canada Inc	556	14	555,856	0	0	556,426
Chemical Manufacturing	Edmonton Hydrogen Facility	Air Products Canada Ltd	648,319	188	930	0	0	649,437
Chemical Manufacturing	Fort Saskatchewan Nitrogen Operation	Agrium inc.	507,100	805	1,583	0	0	509,488
Chemical Manufacturing	FS1 EOEG	MEGlobal Canada Inc.	72,500	902	0	0	0	73,402
Chemical Manufacturing	Joffre LAO Plant	INEOS Canada Partnership	103,160	76	567	0	0	103,803
Chemical Manufacturing	NOVA Chemicals Corporation (Joffre)	NOVA Chemicals Corporation	2,695,556	2,656	12,013	0	96	2,710,321
Chemical Manufacturing	Prentiss Manufacturing Facility	Dow Chemical Canada ULC	37,452	530	28	0	0	38,009
Chemical Manufacturing	Prentiss Manufacturing Facility	MEGlobal Canada Inc.	167,899	972	244	0	0	169,114
Chemical Manufacturing	Scotford Chemical Plant	Shell Chemicals Canada Ltd	316,373	214	789	1,855	0	319,230
Chemical Manufacturing	Western Canada Operations	Dow Chemical Canada ULC	1,387,461	1,815	3,342	2,080	0	1,394,698
Coal Mining	Cheviot Mine (Cardinal River Operations)	Cardinal River Coals Limited (Teck Coal Limited)	70,112	26,118	6,384	0	0	102,614
Coal Mining	Coal Valley Mine	Coal Valley Resources Inc.	132,383	41,063	992	0	0	174,438

Coal Mining	Highvale Coal Mine	TransAlta Generation Partnership	98,563	120,757	965	0	0	220,285
Conventional Oil and Gas Extraction	Balzac Gas Processing Plant	Nexen Inc.	214,967	11,319	1,661	0	0	227,947
Conventional Oil and Gas Extraction	Bonnie Glen Gas Plant	Imperial Oil Resources	40,977	10,181	667	0	0	51,825
Conventional Oil and Gas Extraction	Brazeau Gas Plant	Blaze Energy Ltd.	75,391	11,660	1,396	0	0	88,447
Conventional Oil and Gas Extraction	Brazeau Gas Plant	Keyera Energy	80,385	5,827	3,197	0	0	89,410
Conventional Oil and Gas Extraction	Caribou North Compressor Station	EnCana Oil & Gas Co. Ltd.	50,866	13,141	376	0	0	64,383
Conventional Oil and Gas Extraction	Carstairs - Crossfield Gas Plant	Bonavista Petroleum Ltd.	75,249	829	458	0	0	76,536
Conventional Oil and Gas Extraction	Cochrane Extraction Plant	Inter Pipeline Extraction Ltd.	349,698	8,157	2,261	0	0	360,116
Conventional Oil and Gas Extraction	East Crossfield Gas Plant	PrimeWest Energy Inc.	136,559	6,132	549	0	0	143,240
Conventional Oil and Gas Extraction	Edson Gas Plant	Talisman Energy Inc.	230,324	10,216	1,512	0	0	242,052
Conventional Oil and Gas Extraction	Elmworth Gas Plant	ConocoPhillips Canada (BRC) Ltd.	219,040	21,775	1,825	0	0	242,640
Conventional Oil and Gas Extraction	Empress Straddle Plant	Spectra Energy Empress LP	374,139	3,874	1,823	0	0	379,836
Conventional Oil and Gas Extraction	Hanlan Robb Gas Plant	Petro-Canada Oil & Gas	391,970	15,370	956	0	0	408,296
Conventional Oil and Gas Extraction	Harmattan Gas Processing Plant	Taylor Processing Inc.	246,114	16,860	1,183	0	0	264,156
Conventional Oil and Gas Extraction	K3 1-15 Gas Plant	SemCams ULC	459,933	5,781	2,654	0	0	468,368
Conventional Oil and Gas Extraction	KA 1-12 Gas Plant	SemCams ULC	223,740	11,823	2,573	0	0	238,136
Conventional Oil and Gas Extraction	Mazeppa Sour Gas Plant	Mazeppa Processing Partnership	76,828	3,695	198	0	0	80,720
Conventional	Nevis Gas Plant	Keyera Energy	105,908	8,865	480	0	0	115,253

Oil and Gas Extraction								
Conventional Oil and Gas Extraction	Olds Gas Plant	Pengrowth Corporation	108,365	2,667	1,933	0	0	112,965
Conventional Oil and Gas Extraction	Quirk Creek Gas Plant	Imperial Oil Resources	86,680	5,418	694	0	0	92,792
Conventional Oil and Gas Extraction	Ram River	Husky Oil Operations Ltd	657,158	3,993	1,469	0	0	662,621
Conventional Oil and Gas Extraction	Rimbey Gas Plant	Keyera Energy	232,136	6,848	2,907	0	0	241,891
Conventional Oil and Gas Extraction	Shell Burnt Timber Gas Plant	Shell Canada Limited	166,400	42,483	956	0	0	209,840
Conventional Oil and Gas Extraction	Shell Caroline Complex	Shell Canada Limited	562,921	71,529	4,373	0	0	638,823
Conventional Oil and Gas Extraction	Shell Jumping Pound Gas Plant	Shell Canada Limited	272,850	81,206	2,360	0	0	356,416
Conventional Oil and Gas Extraction	Strachan Gas Plant	Keyera Energy	263,823	8,815	2,587	0	0	275,225
Conventional Oil and Gas Extraction	Wapiti Gas Plant	Devon Canada Corporation	113,579	5,262	1,304	0	0	120,145
Conventional Oil and Gas Extraction	Waterton Complex	Shell Canada Limited	257,646	32,070	3,562	0	0	293,277
Conventional Oil and Gas Extraction	Wildcat Hills Gas Plant	Petro-Canada Oil & Gas	125,539	3,966	2,738	0	0	132,242
Conventional Oil and Gas Extraction	Windfall 8-17 Gas Plant	SemCams ULC	150,504	12,604	4,478	0	0	167,586
Mineral Manufacturing	Exshaw	Graymont Western Canada Inc.	157,606	19	196	0	0	157,821
Mineral Manufacturing	Exshaw Cement Plant	Lafarge Canada Inc	1,112,560	0	0	0	0	1,112,560
Mineral Manufacturing	Fort Saskatchewan	Sherritt International Corporation	285,363	3,932	2,979	0	0	292,275
Mineral Manufacturing	GenAlta Recycling Inc.	General Scrap Partnership	679	0	0	0	0	679

Mineral Manufacturing	Lehigh Inland Cement	Lehigh Cement	838,009	0	0	0	0	838,009
Mineral Manufacturing	Navajo Metals	General Scrap Partnership	1,802	1	59	0	0	1,862
Oil Sands In Situ Extraction	Christina Lake SAGD Bitumen Battery	FCCL Oil Sands Partnership	176,864	1,139	304	0	0	178,307
Oil Sands In Situ Extraction	Cold Lake	Imperial Oil Resources	4,497,260	11,282	24,008	0	0	4,532,550
Oil Sands In Situ Extraction	Foster Creek SAGD Bitumen Battery	FCCL Oil Sands Partnership	678,474	4,134	1,095	0	0	683,702
Oil Sands In Situ Extraction	Great Divide	Connacher Oil and Gas Limited	154,946	403	255	0	0	155,604
Oil Sands In Situ Extraction	Hangingstone SAGD Demonstration Facility	Japan Canada Oil Sands Limited	233,115	1,218	380	0	0	234,713
Oil Sands In Situ Extraction	Jackfish SAGD Plant	Devon Canada Corporation	264,247	2,202	599	0	0	267,049
Oil Sands In Situ Extraction	Long Lake Project	Nexen Inc.	724,456	24,188	4,405	0	0	753,050
Oil Sands In Situ Extraction	MacKay River, In-Situ Oil Sands Plant	Petro-Canada	168,299	211	955	0	0	169,464
Oil Sands In Situ Extraction	Orion Complex	Shell Canada Limited	110,745	12,465	1,997	0	0	125,207
Oil Sands In Situ Extraction	Peace River Complex	Shell Canada Limited	339,926	40,797	5,821	0	0	386,544
Oil Sands In Situ Extraction	Surmont	ConocoPhillips Canada Resources Corp.	323,482	1,852	564	0	0	325,898
Oil Sands In Situ Extraction	Tucker Thermal	Husky Oil Operations Limited	248,262	192	428	0	0	248,881
Oil Sands In Situ Extraction	Wolf Lake/Primrose Thermal Operation	Canadian Natural Resources Limited	2,775,477	72,970	18,041	0	0	2,866,489
Oil Sands Mining and Upgrading	Horizon Oil Sands Processing Plant and Mine	Canadian Natural Resources Limited	438,940	2,928	2,283	0	0	444,151
Oil Sands Mining and Upgrading	Mildred Lake and Aurora North Plant Sites	Syncrude Canada Ltd.	11,465,419	620,722	140,679	0	0	12,226,820
Oil Sands Mining and Upgrading	Muskeg River Mine	Shell Canada Energy	538,703	24,180	4,029	0	0	566,911
Oil Sands Mining and Upgrading	Scotford Upgrader and Upgrader Cogeneration	Shell Canada Energy Limited	1,772,093	5,258	11,402	0	0	1,788,752
Oil Sands Mining and Upgrading	Suncor Energy Inc. Oil Sands	Suncor Energy Inc. Oil Sands	8,392,037	338,500	91,106	0	0	8,821,643
Paper	Alberta-Pacific Forest	Alberta-Pacific Forest	91,675	1,782	18,408	0	0	111,864

Manufacturing	Industries Inc. Pulp Mill	Industries Inc. acting as a						
Paper Manufacturing	Grande Prairie Operations	Weyerhaeuser Company Limited	70,821	23,641	9,339	0	0	103,801
Paper Manufacturing	Hinton Pulp	West Fraser Mills Ltd.	119,473	19,611	9,247	0	0	148,331
Paper Manufacturing	Peace River Pulp Division	Daishowa-Marubeni International Ltd-Peace River Pu	73,001	30,237	10,347	0	0	113,585
Petroleum Refineries	Edmonton Refinery	Petro-Canada	1,421,967	7,393	8,754	0	0	1,438,114
Petroleum Refineries	Shell Scotford Refinery	Shell Canada Products	996,548	7,823	2,540	0	0	1,006,911
Petroleum Refineries	Strathcona Refinery	Imperial Oil Limited	1,406,461	2,204	8,489	0	0	1,417,154
Pipeline Transportation	Alberta Pipeline System	Alliance Pipeline Ltd.	543,457	16,439	3,939	0	0	563,835
Pipeline Transportation	ATCO Pipelines	ATCO Gas and Pipelines Ltd.	49,133	102,665	775	0	0	152,572
Pipeline Transportation	Foothills Pipeline System, Alberta	Foothills Pipe Lines Ltd.	259,393	6,779	3,460	0	0	269,632
Pipeline Transportation	TransCanada Pipeline, Alberta System	Nova Gas Transmission Ltd.	1,508,450	279,671	22,360	0	0	1,810,482
Utilities	ATCO Gas - Distribution Systems and Carbon Plant	ATCO Gas and Pipelines Ltd	33,182	168,496	2,150	0	0	203,828
Utilities	Balzac Power Station	Nexen Inc.	180,748	745	1,454	0	0	182,947
Utilities	Battle River Generating Station	Alberta Power (2000) Ltd.	5,051,042	1,068	22,805	0	0	5,074,916
Utilities	Bear Creek Power Plant	TransCanada Energy Ltd.	78,331	128	660	0	0	79,120
Utilities	Calgary Energy Center	Calgary Energy Centre No. 2 Inc	272,333	426	2,256	0	0	275,015
Utilities	Carseland Power Plant, Alberta	TransCanada Energy Ltd.	307,824	446	2,468	0	0	310,737
Utilities	Cavalier Power Plant	EnCana Corporation	157,387	355	1,255	0	0	158,997
Utilities	Fort Saskatchewan Generating Plant	TransAlta Generation Partnership	342,240	560	2,884	0	0	345,685
Utilities	Foster Creek Cogeneration Facility	FCCL Oil Sands Partnership	468,145	726	5,367	0	69	474,307
Utilities	Genesee Thermal Generating Station	EPCOR Power Generation Services Inc.	8,315,862	2,255	47,162	0	0	8,365,279

Utilities	Grande Prairie Combined Heat and Power Plant	Canadian Gas and Electric	2,148	545	4,987	0	0	7,680
Utilities	H.R. Milner Generating Station	Milner Power Limited Partnership by its GP Milner Power Inc.	752,295	254	4,130	0	0	756,679
Utilities	Keephills Generating Plant	TransAlta Generation Partnership	6,088,588	1,428	41,867	0	0	6,131,884
Utilities	Mackay River Power Plant, Alberta	TransCanada Energy Ltd.	779,410	1,150	6,299	0	0	786,859
Utilities	Medicine Hat Electric Utility	CITY OF MEDICINE HAT	345,629	2,564	2,767	0	0	350,961
Utilities	Muskeg River Cogeneration Power Plant	ATCO Power Canada Ltd.	1,133,307	1,358	6,762	0	0	1,141,427
Utilities	Poplar Hill Generating Station	ATCO Power Canada Ltd.	17,972	30	152	0	0	18,154
Utilities	Rainbow Lake Cogeneration Power Plant (Units 4-5)	ATCO Power Canada Ltd	241,250	404	2,040	0	0	243,694
Utilities	Rainbow Lake Generating Station (Units 1-3)	Alberta Power (2000) Ltd.	29,269	49	247	0	0	29,566
Utilities	Redwater Cogeneration Facility, Alberta	TransCanada Energy Ltd.	174,002	244	1,380	0	0	175,626
Utilities	Scotford Complex	Air Liquide Canada Inc.	421,047	584	3,279	0	0	424,911
Utilities	Sheerness Generating Station	Alberta Power (2000) Ltd.	5,995,812	1,300	27,649	0	0	6,024,761
Utilities	Sturgeon Generating Station	Alberta Power (2000) Ltd.	0	0	0	0	0	0
Utilities	Sundance Generating Plant	TransAlta Generation Partnership	14,791,591	3,560	103,576	0	0	14,898,727
Utilities	Valleyview Generating Station	ATCO Power Canada Ltd.	7,606	13	64	0	0	7,683
Utilities	Wabamun Generating Plant	TransAlta Generation Partnership	2,414,593	614	18,080	0	0	2,433,287
Waste Management	East Calgary Landfill	City of Calgary	13,656	76,776	0	0	0	90,432

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